READEX FICHE best copy available

7/3

Spring 1986 Volume 7, Number 3

LD C
NEWARK PUBLIC LIBRARY

Health Care Financing Review

NEWARK PUBLIC LIBRARY
MAY 22 1986
U. S. GOVT. PUBS.
DEPOSITORY

In this issue

Projections of health care spending to 1990

Comparison of alternative relative weights for diagnosis-related groups

Changes in distribution of Medicare expenditures among aged enrollees, 1969-82

Living arrangement choices of elderly singles: Effects of income and disability

Cost and case-mix differences between hospital-based and freestanding nursing homes

Functional health measure for adjusting health maintenance organization capitation rates

Impact of the Medicare prospective payment system for hospitals

Health Care Financing Administration

E22.18:

Health Care Financing

Review

U.S. Department of Health and Human Services
Otis R. Bowen, M.D., Secretary

Health Care Financing Administration
Henry R. Desmarais, M.D., Acting Administrator

Executive Editor
David J. Butler, Acting Director
Office of Research and Demonstrations

Associate Editors
Allen Dobson, Ph.D., Director
Office of Research

Alfonso D. Esposito, Acting Director
Office of Demonstrations and Evaluations

Managing Editor
Gerri Michael-Dyer, Chief
Publications and Information Resources

Production Manager
Doris H. Simmons

Senior Editor
Alice L. Young

Copy Editors
Margaret Rutherford
Taloria Stevenson

Editorial Assistants
Alice I. Foley
Marlene C. Kidd

Promotion Manager
Linda F. Kropman-Cantale

Send correspondence and news items for the News Briefs section to:
Managing Editor
Health Care Financing Review
Rm. 1-A-9 Oak Meadows Building
6325 Security Boulevard
Baltimore, Maryland 21207

Subscription Information
To subscribe to the *Health Care Financing Review*, send check or money order—$4.25 per single issue, domestic; $5.31 foreign; $18.00 per year, domestic; $22.50, foreign—to Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. All correspondence about paid subscriptions (for example, change of address or failure to receive an issue) should also be addressed to the Superintendent of Documents.

The *Health Care Financing Review* is indexed in the *Index to U.S. Government Periodicals, Abstracts of Health Care Management Studies, Excerpta Medica, MEDOC,* and the *Hospital Literature Index.*

Statements contained in *Review* articles are solely those of the authors and do not express any official opinion or endorsement by the Health Care Financing Administration.

Health Care Financing Review is published quarterly by the Health Care Financing Administration's Office of Research and Demonstrations (ORD). The Office of the Actuary (OACT) contributes the featured statistical report in each issue. The Bureau of Data Management and Strategy (BDMS) provides the health care financing trends data that highlight aspects of the Medicare program.

The Health Care Financing Administration (HCFA) was established to combine health financing and quality assurance programs within a single agency. HCFA is responsible for the Medicare program, Federal participation in the Medicaid program, and a variety of other health care quality assurance programs.

The mission of the Health Care Financing Administration is to promote the timely delivery of appropriate, quality health care to its beneficiaries—approximately 50 million of the Nation's aged, disabled, and poor. The agency must also ensure that program beneficiaries are aware of the services for which they are eligible, that those services are accessible and of high quality, and that agency policies and actions promote efficiency and quality within the total health care delivery system.

The Office of Research and Demonstrations conducts studies and projects that demonstrate and evaluate optional reimbursement, coverage, eligibility, and management alternatives to the present Federal programs. In addition, ORD examines the impact of HCFA programs on health care status, utilization, and expenditures, as well as their effect on beneficiary access to services, health care providers, and the health care industry.

The Office of the Actuary directs the actuarial program for HCFA and monitors national health care expenditures and prices. OACT also provides analyses on the costs of current HCFA programs and the impact of possible legislative or administrative changes in the programs.

The Bureau of Data Management and Strategy operates HCFA's statistical data systems and maintains the national Medicare statistical files. BDMS also serves as the focal point within the agency for information systems policy, planning, and data standards development.

Health Care Financing

Review

Spring 1986
Volume 7, Number 3

U.S. Department of Health and Human Services
Health Care Financing Administration
Office of Research and Demonstrations
Baltimore, Maryland
April 1986

Editorial policy

The editorial policy of the *Health Care Financing Review* is comparable to that of other professional journals. The Executive Editor decides which of the submitted articles are relevant to the health care financing field in general and to the Health Care Financing Administration in particular. *Review* leadership is encouraged to submit appropriate manuscripts for consideration.

The Associate Editors manage the peer review process and are responsible for the professional quality of *Review* articles. All articles of interest are sent to a panel of peers with expertise in the subject areas addressed, and they review articles in terms of substance, originality, validity, clarity, and significance. Their comments, along with those of the Associate Editors, are transmitted to the authors. Authors whose manuscripts are accepted for publication may be asked to make revisions based on these critiques.

The Managing Editor has responsibility for the publications standards of the *Review* and the editorial quality of the articles published and the editorial staff work with authors on preparing their articles for publication.

The *Review* is published on a quarterly basis and each issue represents a balance between contributors from inside and outside the government. Some selective scheduling for publication is necessary because more articles are usually accepted each quarter than can be published in any given issue. However, we will publish all articles of interest that are accepted through the peer review process as space is available.

Contents

Statistical Report

Projections of health care spending to 1990
by Ross H. Arnett, III., David R. McKusick, Sally T. Sonnefeld, and Carol S. Cowell 1

Research Articles

Comparison of alternative relative weights for diagnosis-related groups
by Philip Cotterill, Joel Bobula, and Rose Connerton 37

Changes in distribution of Medicare expenditures among aged enrollees, 1969-82
by Gerald Riley, James Lubitz, Ronald Prihoda, and Mary Ann Stevenson 53

Living arrangement choices of elderly singles: Effects of income and disability
by Christine E. Bishop 65

Cost and case-mix differences between hospital-based and freestanding nursing homes
by Margaret B. Sulvetta and John Holahan 75

Functional health measure for adjusting health maintenance organization capitation rates
by J. William Thomas and Richard L. Lichtenstein 85

Special Report

Impact of the Medicare prospective payment system for hospitals
by Stuart Guterman and Allen Dobson 97

Legislative Update 115

Health Care Financing Trends 119

News Briefs 127

Grants and Contracts 131

Administrator's Decisions 133

Contributors 135

Reviewers 137

Projections of health care spending to 1990

by Ross H. Arnett, III, David R. McKusick, Sally T. Sonnefeld, and Carol S. Cowell

National health expenditures are projected to grow to $640 billion by 1990, 11.3 percent of the gross national product. Growth in health spending is expected to moderate to an 8.7 percent average annual rate from 1984 to 1990, compared with a 12.6 percent rate from 1978 to 1984. These projections assume lower estimates of overall economic price growth, lower use of hospital care, and increased use of less expensive types of care. A preliminary analysis of demographic factors reveals that the aging of the population has almost as great an impact as the growth in total population on projected expenditures for many types of health care services.

Introduction

The health care system continues to change in the delivery, utilization, and financing of health care in response to public and private cost-containment efforts. Pressures are being placed on the health industry to minimize costs by moving to less intensive and less expensive modes of care. Added to this is an increased awareness and cost consciousness on the part of the consumer. The impact of these factors is most evident in the inpatient hospital sector where use continues to decline, attributable in part to a shift in services to less costly alternative sites, but also attributable to the elimination of unnecessary services. As competition for the health dollar intensifies, both within and among the various segments of the health care industry, new marketing strategies are appearing (Coddington, Palmquist, and Trollinger, 1985). Prepayment plans which are combinations of providers (frequently hospitals) and payers (frequently insurers), are an example of these strategies. These responses by providers and payers alike are expected to bring down health care expenditure growth.

Another downward pressure affecting health expenditure growth is a projected moderation in economy-wide price increases. However, health expenditures as a percent of gross national product (GNP) will continue to grow. A force likely to put upward pressure on health care spending is the aging of the population. In the future, demographic factors are expected to have an increasing impact on health spending. These and other emerging trends have been incorporated into the projections. The net result of all these effects is a slowing of expenditure growth during the period 1984-90 to an average annual rate of 8.7 percent (Table 1).

Projection scenario

These projections are based on past trends and relationships observed in the historical estimates of national health expenditures (Levit, Lazenby, Waldo et al., 1985). Variation in national health care spending is attributable to many factors, including economic conditions, sociodemographic changes, and public and private policy shifts. Trend forecasts that reflect average tendencies are used in these projections. The model incorporates economic, actuarial, statistical, demographic, and judgmental factors into a single, integrated framework. It consists of four interrelated components: a five-factor model of expenditure growth, supply variables, a source-of-funds module, and a module for net cost of insurance and program administration costs.

Estimates of health expenditure growth are projected on the basis of the five-factor model. The five factors are population, general price level as measured by the GNP deflator, price relatives that measure the difference between medical service prices and the general inflation rate, units of service consumed per capita, and a residual interpreted as real inputs per unit of service. As a prelude to projecting expenditures to future years, historical expenditures since 1965 are modeled on these five factors, with the residual term accounting for any change not explained by the other four factors. For the projection to future years, predictions of many of the five factors are taken from other forecasters, for example, the economic, population, and manpower assumptions. Other factors such as utilization and the residual are based on analytical judgment,which, in turn, is based in part on historical experience. These components are explained in more detail in the "Projection methodology" section.

Economic assumptions

These projections are based on assumptions in the Board of Trustees: 1985 Annual Report of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Fund. Under these assumptions, the economy will grow at a constant rate of about 3.0 percent per year throughout the projection period 1984-90 (Table 2).

One of the most important factors explaining growth in national health expenditures is movement in economy-wide price levels as measured by the GNP implicit price deflator. Inflation is expected to recede to a 4.6-percent average annual growth, one-third slower than the rate experienced during the period 1974-84. Expressed in other terms, prices are assumed to increase from their present levels, but at a rate

Reprint requests: M. Carol Pearson, Division of National Cost Estimates, Health Care Financing Administration, L-1 1705 Equitable Building, 6325 Security Boulevard, Baltimore, MD 21207.

Table 1

Highlights of national health expenditures, by type of expenditure: Selected years 1984-90

Type of expenditure	1984	1986	1988	1990	Average annual growth rates 1978-84	Average annual growth rates 1984-90
	Amount in billions				Percent	
Total health expenditures	$387	$454	$540	$640	12.8	8.7
Public share	160	187	224	267	13.0	8.9
Private share	227	267	316	372	12.8	8.6
Hospital care	158	181	214	254	13.4	8.2
Community	134	154	184	220	14.9	8.6
Inpatient	114	126	148	174	14.4	7.3
Outpatient	20	28	36	46	18.4	14.5
Physicians' services	75	90	110	132	13.5	9.8
Dentists' services	25	31	37	42	13.0	9.0
Prescription drugs and medical sundries	26	31	37	44	8.9	9.1
Nursing home care	32	39	47	56	14.2	9.8
	Per capita amount					
Total health expenditures	$1,580	$1,812	$2,119	$2,459	11.7	7.7
	Percent of gross national product					
Total health expenditures	10.6	10.8	10.9	11.3	2.7	1.1

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

two-thirds of that experienced from 1974 to 1984. The forecasted deceleration in economy-wide inflation is significant because approximately 60 percent of growth in health care spending can be accounted for by growth in the overall price level (Table 3).

In the short-term, to 1986, the economy's growth rate will slow significantly and inflation will move moderately upward (Table 2). Real GNP, national output after adjusting for price change, is projected to slow to a 3.0 percent rate of growth. In 1984, real GNP exhibited its strongest performance since 1951, reaching almost a 7.0 percent rate of growth. The projected deceleration of real GNP by 1986 implies a contraction in the economy's ability to finance increases for all types of goods and services, including health care. Although real growth is predicted to slow dramatically, inflation is expected to increase, but at less than one-half of 1 percent faster than the rate of 3.8 percent for 1982-84.

For the period 1986-88, current dollar GNP is projected to increase at an average annual rate of 8.3 percent. Real GNP growth is predicted to stabilize at an average annual growth rate of 3.0 percent, and inflation to increase modestly to 5.2 percent. For the last years of the projection, 1988 to 1990, growth in GNP, real GNP, and inflation are all forecasted to slow to average annual rates of growth of 7.2, 2.7, and 4.4 percents, respectively.

Population assumptions

Shifts in the composition of the population have been associated with faster growth in health care expenditures. In 1965, 9.3 percent of the Nation's population was 65 years of age or over (Wade, 1985). By 1984, that age group accounted for 11.6 percent of the population, having an annual growth of more than twice that of the population overall, 2.2 percent compared with 1.0 percent. During the same period, the cohorts of persons 75 years of age or over grew at an average annual rate of 2.8 percent. As discussed in more detail in the "Demographics" section, the aging of the population was accompanied by higher use of health services contributing to rapid health expenditure growth.

In the future, the number of persons 75 years of age or over is projected to continue to grow at 3.0 percent annually, compared to less than 0.9 percent for the overall population and less than 0.7 percent for the population under age 65. The portion of the population 65 years of age or over will rise from 11.6 percent in 1984 to 12.6 in 1990. Those 75 years of age or over are predicted to move from a 1984-level of 4.8 percent to 5.4 percent in 1990. The continued shifts in the age composition assumed in these projections will tend to put upward pressure on health expenditure growth for the remainder of the eighties because of the disproportionate use of health care by the elderly (Fisher, 1980; Waldo and Lazenby, 1984).

Health professional assumptions

The number of active physicians is projected to grow from approximately 506,000 in 1984 to 588,000 in 1990, an annual average increase of 2.5 percent, or almost three times the growth in population for the same period (Table 4). The number of active dentists is projected to increase from almost 138,000 in 1984 to more than 150,000 in 1990, a growth rate almost twice that of population growth. All other factors being equal, the increased number of physicians and dentists per capita will tend to cause an increase in use of health services and thus an increase in health expenditures. Price competition may offset some of the potential increases.

Table 2

Historical estimates and projections of gross national product, inflation, and population: Selected years 1950-90

Calendar year	Gross national product (GNP)			Consumer Price Index (CPI)—all items wage earners (1967 = 100.0)[1,2]	Total population in thousands July 1[3]
	Current dollars in billions	1972 dollars in billions	Implicit price deflator (1972 = 100.0)		
Historical estimates					
1950	$286.5	$534.8	53.5	72.1	157,313
1955	400.1	657.5	60.8	80.3	174,028
1960	506.5	737.2	68.7	88.6	188,943
1965	691.0	929.3	74.4	94.4	203,032
1970	992.7	1,085.6	91.4	116.3	214,034
1974	1,434.2	1,246.3	115.1	147.8	222,435
1975	1,549.2	1,231.7	125.7	161.3	224,484
1978	2,163.8	1,438.5	150.4	195.3	230,835
1980	2,631.7	1,475.0	178.4	246.9	235,885
1981	2,957.8	1,512.2	195.6	272.2	238,299
1982	3,069.2	1,480.0	207.4	288.5	240,743
1983	3,304.8	1,534.7	215.3	297.3	243,066
1984	3,662.8	1,639.3	223.4	307.6	245,226
Projections					
1986	4,207.8	1,737.6	242.2	334.6	249,624
1988	4,934.8	1,842.8	267.8	370.0	253,997
1990	5,671.8	1,943.2	291.9	403.3	258,277
			Average annual percent change		
Selected periods					
1950-55	6.9	4.2	2.6	2.2	2.0
1955-60	4.8	2.3	2.5	2.0	1.7
1960-65	6.4	4.7	1.6	1.3	1.4
1965-70	7.5	3.2	4.2	4.3	1.1
1970-75	9.3	2.6	6.6	6.8	1.0
1975-80	11.2	3.7	7.3	8.9	1.0
1980-85	8.2	2.8	5.3	5.3	1.0
1985-90	7.7	2.8	4.8	4.8	0.9
1974-84	9.8	2.8	6.9	7.6	1.0
1978-84	9.2	2.2	6.8	7.9	1.0
1984-88	7.7	3.0	4.6	4.7	0.9
1984-90	7.6	2.9	4.6	4.6	0.9
1982-84	9.2	5.2	3.8	3.2	0.9
1984-86	7.2	3.0	4.1	4.3	0.9
1986-88	8.3	3.0	5.2	5.2	0.9
1988-90	7.2	2.7	4.4	4.4	0.8

[1] Historical estimates are reported in the *Economic Report of the President*, (1985). Projection growth rates are from Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Insurance Trust Fund, Mar. 1985. II-B assumptions were used. The average annual rate of growth in GNP for 1984-90 used in this projection is within 0.3 percentage points of the rate used by the private consulting firm of Data Resources, Inc.: *U.S. Long-Term Review*. Lexington, Mass., Fall 1985.

[2] The CPI is shown for comparison only. The implicit price deflator for GNP is used in the projection process to reflect cost pressures external to health care industry.

[3] Historical estimates and projections of population are from Wade (1985). Alternative II (intermediate) assumptions for population growth were used.

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Table 3

Factors accounting for growth in expenditures in selected categories of national health expenditures: 1974-84[1]

Factor	Community hospital care[2]			Physicians' services	Dentists' services	Nursing home care excluding ICFMR	Total personal health care	Total national health expenditures
	Inpatient expenses		Outpatient expenses					
	Inpatient days	Admissions						
	Percent distribution							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Economy-wide factors								
General inflation (GNP deflator)	51.2	51.5	40.8	52.8	54.8	53.2	55.2	55.6
Aggregate population growth	7.3	7.5	5.8	7.5	7.8	7.6	7.9	7.9
Health-sector specific factors								
Growth in per capita visits or patient days	-8.5	-.8	10.9	-7.5	4.2	15.0	—	—
Growth in real services per visit or per day (intensity)	33.4	25.4	29.3	27.5	22.1	15.4	[3]21.3	[3]22.9
Medical care price increases in excess of general price inflation	16.6	16.4	13.2	19.7	11.1	8.8	15.6	13.6

[1]For derivation of the method used to allocate factors, see "Projection methodology" section.
[2]Community hospital expenses are split into inpatient and outpatient expenses using the American Hospital Association procedure.
[3]Because of data limitations, this is growth in real services per capita.

NOTES: ICFMR is intermediate care facility for the mentally retarded. GNP is gross national product.

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Table 4

Historical estimates and projections of active physicians and dentists as of December 31: Selected years 1950-90

Year	Number of active physicians			Number of active dentists
	Total	M.D.'s[1]	D.O.'s[2]	
Historical estimates				
1950	219,900	209,000	10,900	79,190
1955	240,200	228,600	11,600	84,370
1960	259,400	247,300	12,200	90,120
1965	288,700	277,600	[2]11,100	95,990
1970	326,500	314,200	12,300	102,220
1974	369,900	356,200	13,700	110,400
1975	384,400	370,400	14,000	112,450
1978	424,000	408,300	15,700	120,620
1980	457,500	440,400	17,100	126,240
1981	466,700	448,700	18,000	129,180
1982	479,900	461,200	18,700	132,010
1983	492,900	473,200	19,700	135,120
1984	506,500	485,700	20,800	137,950
Projections				
1986	534,800	511,600	23,200	143,320
1988	562,000	536,300	25,700	147,410
1990	587,700	559,500	28,200	150,760
	Average annual percent change			
Selected periods				
1950-55	1.8	1.8	1.3	1.3
1955-60	1.6	1.6	1.0	1.3
1960-65	2.2	2.3	[3]–1.9	1.3
1965-70	2.5	2.5	2.1	1.3
1970-75	3.3	3.3	2.6	1.9
1975-80	3.5	3.5	4.1	2.3
1980-85	2.6	2.8	5.1	2.2
1985-90	2.5	2.5	5.2	1.4
1984-86	2.8	2.6	5.6	1.9
1986-88	2.5	2.4	5.3	1.4
1988-90	2.3	2.1	4.8	1.1
1984-88	2.6	2.5	5.4	1.7
1965-84	3.0	3.0	3.4	1.9
1974-84	3.2	3.1	4.3	2.3
1984-90	2.5	2.4	5.2	1.5

[1]Medical doctors.
[2]Doctors of osteopathy.
[3]The decline in the number of active D.O.'s from 1960 to 1965 reflects the granting of approximately 2,400 M.D. degrees to osteopathic physicians who had graduated from the University of California College of Medicine at Irvine. These physicians are included with active M.D.'s beginning in 1962.

SOURCES: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates; (Bureau of Health Professions 1985).

Overview

Outlays for national health expenditures are expected to increase at significantly slower rates from 1984 to 1990 than in the past, both absolutely and in relation to GNP (Table 5). Total spending is projected to increase at an 8.7-percent average annual rate, or at two-thirds of the 12.6 percent rate from 1978 to 1984.

The four factors accounting for historical growth are economy-wide inflation (56 percent), growth in real services expense per use (23 percent), medical care price increases in excess of overall inflation (13 percent), and population growth (8 percent), (Table 3). The projected decline in general inflation and the likely subsequent impact on health sector specific prices, along with continued restrained growth in government financing and private sector cost-containment efforts should exert substantial downward pressure on health spending for the remainder of the eighties. However, the aging of the population and continued introduction of health-enhancing technologies should cause upward pressure on health spending. The net effect of these pressures and constraints should result in a deceleration in the growth of health spending, especially when one considers that the two price measures alone account for about 70 percent of the growth, and both are predicted to slow in the projection period.

Over the projection period, the ratio of health spending to GNP is projected to increase at an average annual rate of 1.1 percent, or only one-third of that for the period 1978-84. In the short-term, as the economy continues to expand, and the effects of both current law reimbursement reform (for example,

Table 5

National health expenditures and average annual percent change, by source of funds and percent of gross national product (GNP): Selected calendar years 1950-90

Calendar year	Gross national product in billions	Total national health expenditures			Private		Public					
							Total		Federal		State and local	
		Amount in billions	Per capita	Percent of GNP	Amount in billions	Percent of total	Amount in billions	Percent of total	Amount in billions	Percent of total	Amount in billions	Percent of total
Historical estimates												
1950	$286.5	$12.7	$82	4.4	$9.2	72.8	$3.4	27.2	$1.6	12.8	$1.8	14.4
1955	400.1	17.7	105	4.4	13.2	74.3	4.6	25.7	2.0	11.3	2.6	14.4
1960	506.5	26.9	146	5.3	20.3	75.3	6.6	24.7	3.0	11.2	3.6	13.5
1965	691.0	41.9	207	6.1	30.9	73.8	11.0	26.2	5.5	13.2	5.5	13.0
1970	992.7	75.0	350	7.6	47.2	63.0	27.8	37.0	17.7	23.6	10.1	13.5
1974	1,434.2	116.1	522	8.1	69.1	59.5	47.0	40.5	30.4	26.2	16.6	14.3
1975	1,549.2	132.7	591	8.6	76.4	57.5	56.3	42.5	37.0	27.9	19.3	14.5
1978	2,163.8	189.7	822	8.8	110.1	58.0	79.6	42.0	53.8	28.4	25.8	13.6
1980	2,631.7	247.5	1,049	9.4	142.2	57.4	105.3	42.6	71.0	28.7	34.3	13.9
1981	2,957.8	285.2	1,197	9.6	164.2	57.6	121.1	42.4	83.4	29.2	37.7	13.2
1982	3,069.2	321.2	1,334	10.5	186.1	57.9	135.1	42.1	93.2	29.0	41.9	13.0
1983	3,304.8	355.1	1,461	10.7	207.0	58.3	148.1	41.7	102.7	28.9	45.4	12.8
1984	3,662.8	387.4	1,580	10.6	227.1	58.6	160.3	41.4	111.9	28.9	48.3	12.5
Projections												
1986	4,207.8	454.2	1,820	10.8	266.9	58.8	187.3	41.2	132.1	29.1	55.2	12.2
1988	4,934.8	539.9	2,126	10.9	316.0	58.5	223.8	41.5	159.7	29.6	64.1	11.9
1990	5,671.8	639.6	2,476	11.3	372.4	58.2	267.2	41.8	193.4	30.2	73.8	11.5
						Average annual percent change						
Selected periods												
1950-55	6.9	6.9	5.2	—	7.4	—	5.8	—	4.6	—	7.6	—
1955-60	4.8	8.7	6.8	—	9.0	—	7.8	—	8.5	—	6.7	—
1960-65	6.4	9.2	7.6	—	8.8	—	10.2	—	12.9	—	7.6	—
1965-70	7.5	12.3	11.2	—	8.8	—	20.4	—	26.1	—	13.1	—
1970-75	9.3	12.1	11.0	—	10.1	—	15.2	—	16.0	—	13.8	—
1975-80	11.2	13.3	12.2	—	13.2	—	13.3	—	13.9	—	12.2	—
1980-85	8.2	11.0	10.0	—	11.4	—	10.6	—	11.6	—	8.5	—
1985-90	7.7	8.9	8.0	—	8.9	—	8.9	—	9.5	—	7.5	—
1978-84	9.2	12.6	11.5	—	12.8	—	12.4	—	13.0	—	11.0	—
1984-88	7.7	8.7	7.7	—	8.6	—	8.7	—	9.3	—	7.3	—
1984-86	7.2	8.3	7.3	—	8.4	—	8.1	—	8.6	—	6.9	—
1986-88	8.3	9.0	8.1	—	8.8	—	9.3	—	9.9	—	7.8	—
1988-90	7.2	8.8	7.9	—	8.5	—	9.3	—	10.1	—	7.3	—
1965-84	9.2	12.4	11.3	—	11.1	—	15.1	—	17.1	—	12.2	—
1974-84	9.8	12.8	11.7	—	12.6	—	13.0	—	13.9	—	11.3	—
1984-90	7.6	8.7	7.8	—	8.6	—	8.9	—	9.5	—	7.3	—

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates; (Levit et al. 1985.)

the Medicare prospective payment system) and the strong private sector initiatives continue to contain costs, the health care sector's share of GNP should remain fairly stable, increasing slowly from 10.6 percent in 1984 to 10.8 in 1986. A gradual increase in this share is projected for the remainder of the eighties, reaching 11.3 percent in 1990. This proportion can be expected to be higher if the assumption for a relatively strong real GNP growth does not materialize.

During the period 1978 to 1984, current dollar or nominal GNP increased at a 9.2 percent average annual rate, and national health expenditures increased at a 12.6 percent rate (Table 5). This rapid growth in health care spending relative to the Nation's ability to pay for it was a factor that prompted Congress, States, and private industry to develop cost-containment initiatives. Health care markets and institutions are adjusting to these new incentives and constraints, and a new health care environment is emerging. Thus, for the projection period, GNP is predicted to grow at a 7.6 percent average annual rate, and health spending is projected to grow at an 8.7 percent rate. This reflects a narrowing of the differential between growth in health care costs and growth in the overall economy.

Shifts from the historical trend in relative shares of spending going to the various types of health services are occurring (Table 6). They reflect changes in the health care delivery system. The hospital share of personal health care expenditures, which historically had been increasing, decreased from 47.3 percent in 1982 to 46.2 percent in 1984. The hospital share is projected to continue to decline slowly to a 44.4-percent share of the health dollar by 1990. Reforms in the payment systems for hospital care and increasing competition from ambulatory services will result in the deceleration of spending growth for hospital care relative to other services. The reduced demand for inpatient services will be partially offset by increases in both the physician and nursing home shares.

Government financing

The Federal share of total health expenditures has grown slowly but continuously from 23.2 percent in 1967, the first full year of Medicare and Medicaid, to 29.2 percent in 1981, then declined slightly to 28.9 percent in 1984 (Table 5). Medicare's share, the largest single component of Federal health care spending, grew continuously from 1968 to 1984, except for the period of wage and price controls in the early 1970's. Federal Medicaid spending has declined as a share of the total of Federal spending since about 1980, partly because of budget constraints. Other Federal spending, consisting mostly of Federal hospitals, has declined as a share of the total for the last two decades. Continued modest declines in Federal Medicaid and other Federal spending are projected through 1990. Total Federal Medicare costs are projected to be almost $119 billion in 1990 (Table 7); Federal Medicaid costs for 1990 will be nearly $34 billion (Table 8).[1]

Medicare is projected to grow as a fraction of all health care spending largely because the Medicare population is growing faster than the population as a whole, and because longevity is increasing in the Medicare population. A temporary moderation in the rise should occur in 1986 as a result of the freeze on the payments for diagnosis-related groups under part A of Medicare. In this projection scenario, Federal payments for health will rise from almost $112 billion in 1984, just under 13 percent of total Federal budget, to more than $193 billion in 1990, almost 15 percent of the Federal budget.

State and local governments have funded about 13 percent of total health care for the last two decades. A modest decline in the State and local share over the past 4 years is projected to continue through the projection period, resulting in State and local governments paying for 11.5 percent of health care costs.

Private financing

After years of steady decline, the portion of health care financed by the private sector seems to have stabilized at just under 60 percent (Table 5). Prior to the Medicare and Medicaid programs, the private sector financed three-quarters of national health expenditures. Also stabilizing are the components of private financing: patient direct payments, private insurance, and other private payments (philanthropy and industrial inplant health facilities). At first glance, this stability is somewhat surprising in what otherwise might be characterized as a rather tumultuous time in the health care industry. However, the number of persons with private insurance has been reasonably constant for several years, especially for the big expenditure items such as hospital care and physicians' services. Even the movement in the late 1970's to insure for dental and vision care has waned. The cost-containment effort leading to increases in deductibles and coinsurance seems to have had some impact on use of services, but does not seem to have had much net effect on the proportion of health expenditures financed by patient direct payments.

New forms of insurance arrangements have been developed recently, in part as a response to the competitive pressures of cost containment. Health maintenance organizations are a long-standing example of a provider/insurance arrangement. New versions of this type of organization have grown out of the preferred provider movement. Preferred provider organizations (PPO's) are basically a discount system which, in principle, benefits both the purchaser and the provider, one receiving lower cost health services and the other increasing its potential

[1]These projections of Medicare spending do not take into account potential impacts from the Gramm-Rudman-Hollings legislation.

Table 6

Percent distribution of personal health care costs, by type of service: Selected years 1950-90

Calendar year	Total	Type of personal health care expenditure							
		Hospital care	Physicians' services	Dentists' services	Other professional services	Drugs and medical sundries	Eyeglasses and appliances	Nursing home care	Other health services
	Percent distribution								
Historical estimates									
1950	100.0	35.4	25.2	8.8	3.6	15.9	4.5	1.7	4.8
1960	100.0	38.4	24.0	8.3	3.6	15.4	3.3	2.2	4.7
1965	100.0	39.0	23.6	7.8	2.9	14.4	3.3	5.8	3.2
1970	100.0	42.8	21.9	7.3	2.4	12.2	3.0	7.2	3.2
1975	100.0	44.8	21.3	7.0	2.2	10.2	2.7	8.6	3.2
1980	100.0	46.2	21.4	7.0	2.6	8.5	2.3	9.3	2.7
1982	100.0	47.3	21.7	6.8	2.5	7.7	2.0	9.4	2.7
1984	100.0	46.2	22.1	7.3	2.6	7.6	2.2	9.4	2.8
Projections									
1986	100.0	44.9	22.5	7.6	2.7	7.7	2.2	9.7	2.8
1988	100.0	44.4	22.8	7.6	2.8	7.7	2.1	9.8	2.9
1990	100.0	44.4	23.1	7.3	2.8	7.6	2.1	9.8	2.9

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Table 7

Medicare benefit payments, by type of service and administrative expenses: Selected years 1970-90[1]

Calendar year	Medicare benefits and administrative expenses	Benefits							Administrative expenses
		Total	Hospital care	Physicians' services	Other professional services[2]	Eyeglasses and appliances	Nursing home care	Other personal health care	
	Amount in billions								
Historical estimates[3]									
1970	$7.5	$7.1	$5.1	$1.6	$0.1	([5])	$0.3	([5])	$0.4
1974	13.1	12.4	9.2	2.7	0.1	$0.1	0.2	$0.1	0.7
1975	16.3	15.6	11.5	3.4	0.2	0.1	0.3	0.1	0.7
1978	25.9	24.9	18.2	5.4	0.4	0.2	0.3	0.3	1.0
1980	36.8	35.7	25.9	7.9	0.7	0.4	0.4	0.5	1.1
1981	44.7	43.5	31.4	9.7	0.8	0.5	0.4	0.6	1.3
1982	52.4	51.1	36.8	11.4	1.1	0.6	0.5	0.7	1.3
1983	58.8	57.4	40.5	13.4	1.4	0.8	0.5	0.8	1.4
1984	64.6	63.1	44.4	14.6	1.7	1.0	0.6	0.9	1.6
Projections[4]									
1986	77.5	75.7	51.9	18.7	2.1	1.3	0.7	1.0	1.8
1988	95.8	93.6	64.4	22.9	2.6	1.6	0.8	1.2	2.1
1990	118.6	116.2	79.6	29.0	3.2	2.0	0.9	1.5	2.5
	Average annual percent change								
Selected periods									
1974-84	17.3	17.6	17.0	18.5	29.1	27.0	8.6	27.9	8.7
1978-84	16.4	16.7	16.0	17.8	25.3	27.1	8.4	17.5	8.0
1984-86	9.5	9.6	8.1	13.2	12.6	15.6	9.0	8.8	8.4
1984-88	10.3	10.4	9.7	12.0	11.9	14.5	9.1	8.9	8.0
1984-90	10.7	10.7	10.2	12.1	11.6	13.4	9.0	8.6	7.7

[1] Service categories used in this table differ from those used in the annual reports of the Board of Trustees of the Federal Hospital Insurance and Supplementary Medical Insurance Trust Funds. For example, hospital-based home health services appear as hospital care rather than as home health services (which are included in other professional services).
[2] Hospice benefits are included with other professional services. The benefit provision was effective November 1, 1983, and expires October 1, 1986.
[3] Historical data are from Levit et al. (1985).
[4] Projections are derived from Board of Trustees, Federal Hospital Insurance and Supplementary Medical Insurance Trust Fund, Mar. 1985.
[5] Less than $50 million.

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Table 8

Federal share of Medicaid benefits, administrative expenses, and average annual percent change: Selected years 1970-90

Calendar year	Total	Benefits	Administrative expenses
	Amount in billions		
Historical estimates[1]			
1970	$3.0	$2.9	$0.1
1974	6.4	6.1	0.3
1975	7.9	7.6	0.4
1978	11.2	10.4	0.7
1980	14.5	13.6	0.8
1981	17.3	16.2	1.1
1982	18.0	17.0	1.0
1983	19.3	18.3	1.1
1984	20.9	19.7	1.2
Projections			
1986	24.4	23.0	1.4
1988	28.5	27.0	1.5
1990	33.7	32.0	1.6
	Average annual percent change		
1974-84	12.6	12.4	15.4
1978-84	11.0	11.2	8.7
1984-86	8.0	8.0	8.5
1984-88	8.1	8.2	6.4
1984-90	8.3	8.5	5.6

[1] Historical Medicaid financial data on outlays reflect changes in services incurred and cash flow adjustments (Levit et al., 1985).

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

market share. Some of the arrangements have now added an element of prepayment. A growing number of these PPO's are assuming the insurance risk by providing care in return for a set prepaid amount. Examples of this form are Humana's Care Plus and the Managed Premium Preferred Provider Organization (MPPPO), Partners, set up by the Voluntary Hospitals of America and Aetna (Cassak, 1985).

Projections by type of service

Presented here is a discussion of national health expenditures by type of expenditure and sources of payment. Data are presented showing both expenditure and payment levels and the distribution of payment sources (Tables 9 and 10).

Hospital care

Hospital care accounts for more than 46 percent of personal health care spending and, thus, during the recent period of rapidly rising health care costs, has been the focus of much national attention. Both the public and private sectors have instituted extensive cost-containment programs. The public initiatives such as the Medicare prospective payment system (PPS), and an increased emphasis on peer review organizations are well known. The private sector has developed a variety of approaches to control costs, such as second opinions, increased deductibles and coinsurance, preferred provider organizations, health maintenance organizations (HMO's), coordination of benefits, and utilization review and audit of provider bills. An examination of recent hospital data reveals that the efforts of both sectors seem to have had the desired effect on costs.

Total hospital expenditures are projected to grow from their 1984 level of $158 billion to almost $254 billion in 1990 (Table 11). Hospital expenditures during the period 1984-90 are projected to grow at an 8.2 percent rate, compared with a 12.9 percent rate during the period 1978-84 (Table 12). The slowest growth, 7.0 percent, occurs during the period 1984-86, a time of significant declines in utilization.

Community hospital inpatient

Expenditures for community hospital inpatient services are projected to increase from $114 billion in 1984 to more than $174 billion in 1990. This reflects an average annual rate of growth of 7.3 percent, down from the 14.4 percent growth rate during the period 1978-84. Community hospital costs per day and stay are projected to increase from 1984 levels of $443 and $2,947, respectively to $747 and $4,781 in 1990. These estimates also represent a decrease in the overall growth rate compared with the period 1978-84. To some extent, these declines are offset by increases in outpatient care and care in nonhospital settings. However, to a large degree, the hospital reductions seem to represent reductions in overall health care spending.

Preliminary data for 1985 suggest that hospital admissions will decline about 5.5 percent and total days by about 7.5 percent. The comparable decreases for 1984 were 3.7 and 8.7 percent for admissions and days, respectively. Because the number of days dropped faster than did admissions, the average length of stay declined. At some point, one would expect this drop in length of stay to stabilize or even reverse, because the patients admitted will be sicker, on average, than those admitted prior to cost-containment efforts (Barkholz, 1985).

The decline in admissions may be attributed to several factors. Cost-containment efforts such as second opinions and new nonsurgical treatment modalities are having an impact, but there are also reports of new consumer awareness and concern. Many consumers are demanding outpatient treatment when possible. To some extent, this phenomenon may be in response to employer incentives such as increased deductibles and coinsurance, but there also seems to be a new consumer inclination to question the health care they are receiving and a desire to try less invasive and less expensive alternatives before entering the hospital (Goldsmith, 1984).

Most industry analysts still express uncertainty as to how long the hospital inpatient declines will continue (Davis, Anderson, Renn, et al., 1985). Many predict that we are at or near the bottom of the declines, and that forces such as the aging of the population and limits as to how much more cost containment efforts

Table 9

National health expenditures, by type of expenditure and source of funds: Selected years 1974-90

Type of expenditure	Total	Private					Public		
		Total	Consumer			Other	Total	Federal	State and local
			Total	Patient direct	Health insurance				
	Amount in billions								
1974 Total	$116.1	$69.1	$64.0	$36.2	$27.9	$5.0	$47.0	$30.4	$16.6
Health services and supplies	108.6	65.8	64.0	36.2	27.9	1.7	42.9	27.8	15.1
Personal health care	101.3	62.8	61.3	36.2	25.1	1.5	38.5	25.7	12.8
Hospital care	45.0	20.6	20.0	4.9	15.1	0.6	24.4	16.7	7.7
Physicians' services	21.2	15.9	15.9	7.7	8.1	(1)	5.4	3.8	1.6
Dentists' services	7.4	7.0	7.0	6.3	0.6	—	.4	.2	.2
Other professional services	2.2	1.8	1.8	1.4	.4	(1)	.4	.2	.1
Drugs and medical sundries	11.0	10.1	10.1	9.5	.6	—	.9	.4	.4
Eyeglasses and appliances	2.8	2.6	2.6	2.5	.1	—	.2	.1	(1)
Nursing home care	8.5	3.9	3.9	3.8	.1	.1	4.6	2.6	2.0
Other health services	3.1	.8	—	—	—	.8	2.3	1.6	.7
Program administration and net cost of insurance	4.7	3.0	2.8	—	2.8	.2	1.7	1.0	.6
Government public health activities	2.7	—	—	—	—	—	2.7	1.1	1.7
Research and construction of medical facilities	7.5	3.3	—	—	—	3.3	4.2	2.6	1.6
Research[2]	2.8	.3	—	—	—	.3	2.5	2.3	.3
Construction	4.7	3.1	—	—	—	3.1	1.6	.3	1.3
1984 Total	387.4	227.1	215.9	95.4	120.5	11.2	160.3	111.9	48.3
Health services and supplies	371.6	220.3	215.9	95.4	120.5	4.4	151.2	105.4	45.9
Personal health care	341.8	206.5	202.5	95.4	107.2	3.9	135.4	101.1	34.3
Hospital care	157.9	73.5	71.9	13.7	58.2	1.6	84.3	65.6	18.7
Physicians' services	75.4	54.5	54.4	21.0	33.5	(1)	20.9	16.9	4.0
Dentists' services	25.1	24.5	24.5	16.3	8.3	—	.5	.3	.3
Other professional services	8.8	6.0	5.9	3.5	2.4	.1	2.8	2.2	.6
Drugs and medical sundries	25.8	23.5	23.5	19.7	3.8	—	2.4	1.2	1.2
Eyeglasses and appliances	7.4	6.3	6.3	5.5	.8	—	1.2	1.1	.1
Nursing home care	32.0	16.3	16.1	15.8	.3	.2	15.7	8.8	6.9
Other health services	9.4	2.0	—	—	—	2.0	7.5	5.1	2.4
Program administration and net cost of insurance	19.1	13.9	13.4	—	13.4	.5	5.2	2.9	2.3
Government public health activities	10.7	—	—	—	—	—	10.7	1.4	9.3
Research and construction of medical facilities	15.8	6.7	—	—	—	6.7	9.0	6.6	2.5
Research[2]	6.8	.4	—	—	—	.4	6.4	5.8	.6
Construction	9.0	6.4	—	—	—	6.4	2.6	.7	1.9

See footnotes at end of table.

Table 9—Continued

National health expenditures, by type of expenditure and source of funds: Selected years 1974-90

Type of expenditure	Total	Private					Public		
		Total	Consumer			Other	Total	Federal	State and local
			Total	Patient direct	Health insurance				
	Amount in billions								
1986 Total	$454.2	$266.9	$254.8	$112.9	$141.9	$12.1	$187.3	$132.1	$55.2
Health services and supplies	437.2	260.0	254.8	112.9	141.9	5.1	177.2	124.5	52.7
Personal health care	402.9	244.1	239.5	112.9	126.6	4.6	158.8	119.6	39.2
Hospital care	180.8	84.4	82.5	15.7	66.8	1.9	96.4	75.7	20.6
Physicians' services	90.5	64.4	64.4	24.4	40.0	(3)	26.0	21.4	4.6
Dentists' services	30.7	30.1	30.1	19.8	10.2	—	.6	.3	.3
Other professional services	10.9	7.3	7.2	4.1	3.1	.1	3.6	2.8	.8
Drugs and medical sundries	31.0	28.1	28.1	23.2	4.9	—	2.9	1.5	1.4
Eyeglasses and appliances	8.8	7.2	7.2	6.2	1.0	—	1.6	1.4	.1
Nursing home care	38.9	20.3	20.0	19.5	.5	.3	18.6	10.4	8.2
Other health services	11.4	2.3	—	—	—	2.3	9.1	6.1	3.0
Program administration and net cost of insurance	21.9	15.9	15.3	—	15.3	.6	6.0	3.4	2.6
Government public health activities	12.3	—	—	—	—	—	12.3	1.5	10.9
Research and construction of medical facilities	17.0	6.9	—	—	—	6.9	10.1	7.6	2.5
Research	7.8	.4	—	—	—	.4	7.4	6.7	.7
Construction	9.2	6.5	—	—	—	6.5	2.7	.9	1.8
1988 Total	539.9	316 0	302.4	133.9	168.4	13.7	223.8	159.7	64.1
Health services and supplies	520.8	308.4	302.4	133.9	168.4	6.0	212.4	151.1	61.3
Personal health care	481.3	290.4	285.0	133.9	151.1	5.3	191.0	145.6	45.3
Hospital care	213.7	98.1	95.9	17.5	78.4	2.2	115.6	92.4	23.1
Physicians' services	109.8	78.1	78.0	29.8	48.3	.1	31.7	26.1	5.6
Dentists' services	36.5	35.8	35.8	23.5	12.3	—	.7	.3	.3
Other professional services	13.3	8.8	8.7	4.8	3.9	.1	4.5	3.5	1.0
Drugs and medical sundries	37.1	33.8	33.8	27.6	6.2	—	3.3	1.7	1.6
Eyeglasses and appliances	10.3	8.3	8.3	7.1	1.2	—	2.0	1.8	.2
Nursing home care	47.0	24.8	24.5	23.7	.8	.3	22.2	12.4	9.8
Other health services	13.7	2.6	—	—	—	2.6	11.1	7.4	3.7
Program administration and net cost of insurance	24.8	18.0	17.3	—	17.3	.7	6.8	3.9	3.0
Government public health activities	14.6	—	—	—	—	—	14.6	1.6	13.0
Research and construction of medical facilities	19.1	7.7	—	—	—	7.7	11.4	8.6	2.8
Research	8.9	.4	—	—	—	.4	8.4	7.6	.8
Construction	10.2	7.2	—	—	—	7.2	3.0	1.0	2.0

See footnotes at end of table.

Table 9—Continued

National health expenditures, by type of expenditure and source of funds: Selected years 1974-90

Type of expenditure	Total	Private					Public		
		Total	Consumer			Other	Total	Federal	State and local
			Total	Patient direct	Health insurance				
	Amount in billions								
1990 Total	$639.6	$372.4	$356.8	$156.6	$200.2	$15.6	$267.2	$193.4	$73.8
Health services and supplies	618.0	363.6	356.8	156.6	200.2	6.9	254.3	183.6	70.7
Personal health care	571.3	342.0	335.9	156.6	179.3	6.1	229.4	177.6	51.8
Hospital care	253.5	116.0	113.4	20.9	92.5	2.6	137.6	112.3	25.2
Physicians' services	131.8	92.5	92.4	34.7	57.7	.1	39.3	32.7	6.6
Dentists' services	41.9	41.2	41.2	27.0	14.3	—	.7	.4	.4
Other professional services	16.0	10.4	10.3	5.5	4.8	.1	5.6	4.3	1.3
Drugs and medical sundries	43.6	39.9	39.9	32.4	7.5	—	3.7	1.8	1.8
Eyeglasses and appliances	11.9	9.5	9.5	8.0	1.4	—	2.4	2.2	.2
Nursing home care	56.3	29.6	29.2	28.1	1.1	.4	26.6	14.8	11.8
Other health services	16.3	2.8	—	—	—	2.8	13.5	8.9	4.6
Program administration and net cost of insurance	29.2	21.6	20.8	—	20.8	.8	7.6	4.3	3.2
Government public health activities	17.4	—	—	—	—	—	17.4	1.7	15.7
Research and construction of medical facilities	21.6	8.7	—	—	—	8.7	12.9	9.8	3.1
Research[2]	10.1	.5	—	—	—	.5	9.7	8.7	.9
Construction	11.5	8.2	—	—	—	8.2	3.2	1.0	2.2

[1] Spending by philanthropic organizations, industrial in-plant health services, and privately financed construction.
[2] Research and development expenditures of drug companies and other manufacturers and providers of medical equipment and supplies are excluded from "research expenditures," but are included in the expenditure class in which the product falls.
[3] Less than $50 million.

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Table 10

Percent distribution of national health expenditures, by source of funds and type of expenditure: Selected years 1965-90

Type of expenditure and year	Total	Private				Public		
		Total	Patient direct	Health insurance	Other	Total	Federal	State and local
Hospital care								
Historical								
1965	100.0	60.1	16.8	41.1	2.2	39.9	17.4	22.5
1970	100.0	47.6	11.4	34.6	1.6	52.5	34.1	18.4
1975	100.0	44.9	7.9	35.9	1.1	55.1	38.4	16.7
1980	100.0	46.5	7.4	38.1	1.0	53.6	40.6	13.0
1982	100.0	47.2	7.6	38.5	1.0	52.8	41.1	11.7
1984	100.0	46.6	8.7	36.9	1.0	53.5	41.6	11.9
Projected								
1986	100.0	46.7	8.7	37.0	1.0	53.3	41.9	11.4
1988	100.0	45.9	8.2	36.7	1.0	54.1	43.3	10.8
1990	100.0	45.7	8.2	36.5	1.0	54.2	44.3	9.9
Physicians' services								
Historical								
1965	100.0	93.1	61.6	31.4	.1	6.9	1.8	5.1
1970	100.0	79.1	45.4	33.6	.1	20.9	14.9	6.0
1975	100.0	73.7	34.1	39.5	.1	26.4	18.8	7.6
1980	100.0	73.1	30.5	42.5	.1	26.9	20.6	6.3
1982	100.0	72.6	28.7	43.8	.1	27.4	21.7	5.7
1984	100.0	72.2	27.8	44.4	.1	27.7	22.4	5.3
Projected								
1986	100.0	71.2	27.0	44.2	.1	28.7	23.6	5.1
1988	100.0	71.2	27.1	44.0	.1	28.8	23.8	5.1
1990	100.0	70.2	26.4	43.8	.1	29.8	24.8	5.0
Dentists' services								
Historical								
1965	100.0	98.3	97.1	1.2	—	1.7	1.1	.6
1970	100.0	95.3	90.2	5.1	—	4.7	2.7	2.0
1975	100.0	94.3	80.5	13.9	—	5.6	3.3	2.3
1980	100.0	96.1	65.6	30.5	—	3.9	2.2	1.7
1982	100.0	97.1	63.5	33.6	—	2.9	1.5	1.4
1984	100.0	97.8	64.8	33.0	—	2.1	1.1	1.0
Projected								
1986	100.0	98.0	64.6	33.4	—	2.0	1.0	1.0
1988	100.0	98.2	64.4	33.8	—	1.8	.9	.9
1990	100.0	98.3	64.3	34.0	—	1.7	.9	.8

See footnotes at end of table.

Table 10—Continued

Percent distribution of national health expenditures, by source of funds and type of expenditure: Selected years 1965-90

Type of expenditure and year	Total	Private				Public		
		Total	Patient direct	Health insurance	Other	Total	Federal	State and local
Drugs and medical sundries								
Historical								
1965	100.0	96.2	93.6	2.6	—	3.8	2.3	1.5
1970	100.0	93.9	90.2	3.8	—	6.1	3.0	3.1
1975	100.0	91.4	84.9	6.5	—	8.6	4.4	4.2
1980	100.0	91.3	79.6	11.7	—	8.7	4.3	4.4
1982	100.0	91.1	77.6	13.5	—	8.9	4.4	4.5
1984	100.0	90.8	76.2	14.6	—	9.2	4.7	4.5
Projected								
1986	100.0	90.7	74.8	15.9	—	9.4	4.8	4.6
1988	100.0	91.2	74.5	16.7	—	8.8	4.5	4.3
1990	100.0	91.6	74.4	17.2	—	8.4	4.2	4.2
Nursing home care								
Historical								
1965	100.0	65.7	64.5	.1	1.0	34.3	22.2	12.1
1970	100.0	51.4	50.3	.4	.7	48.6	28.6	20.0
1975	100.0	44.0	42.7	.7	.6	56.0	31.4	24.6
1980	100.0	45.1	43.6	.9	.6	54.9	29.6	25.3
1982	100.0	47.8	46.2	.9	.7	52.1	28.4	23.7
1984	100.0	51.0	49.4	.8	.7	49.0	27.3	21.7
Projected								
1986	100.0	52.2	50.2	1.2	.7	47.9	26.7	21.2
1988	100.0	52.8	50.4	1.6	.7	47.2	26.3	20.9
1990	100.0	52.7	49.9	2.0	.7	47.4	26.4	21.0

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Table 11

National health expenditures, by type of expenditure: Selected years 1950-90

Type of expenditure	1950	1955	1960	1965	1970	1974	1975	1978	1980	1982	1983	1984	1986	1988	1990
	Amount in billions														
Total	$12.7	$17.7	$26.9	$41.9	$75.0	$116.1	$132.7	$189.7	$247.5	$321.2	$355.1	$387.4	$454.2	$539.9	$639.6
Health services and supplies	11.7	16.9	25.2	38.4	69.6	108.6	124.3	179.9	235.6	307.0	339.8	371.6	437.2	520.8	618.0
Personal health care	10.9	15.7	23.7	35.9	65.4	101.3	117.1	167.4	219.1	284.9	315.2	341.8	402.9	481.3	571.3
Hospital care	3.9	5.9	9.1	14.0	28.0	45.0	52.4	76.2	101.3	134.7	148.8	157.9	180.8	213.7	253.5
Physicians' services	2.7	3.7	5.7	8.5	14.3	21.2	24.9	35.8	46.8	61.8	68.4	75.4	90.5	109.8	131.8
Dentists' services	1.0	1.5	2.0	2.8	4.7	7.4	8.2	11.8	15.4	19.5	21.8	25.1	30.7	36.5	41.9
Other professional services	0.4	0.6	0.9	1.0	1.6	2.2	2.6	4.1	5.6	7.1	8.0	8.8	10.9	13.3	16.0
Drugs and medical sundries	1.7	2.4	3.7	5.2	8.0	11.0	11.9	15.4	18.5	21.8	23.6	25.8	31.0	37.1	43.6
Eyeglasses and appliances	0.5	0.6	0.8	1.2	1.9	2.8	3.2	4.2	5.1	5.6	6.5	7.4	8.8	10.3	1.9
Nursing home care	0.2	0.3	0.5	2.1	4.7	8.5	10.1	15.1	20.4	26.9	29.4	32.0	38.9	47.0	56.3
Other health services	0.5	0.9	1.1	1.1	2.1	3.1	3.8	4.8	5.9	7.6	8.6	9.4	11.4	13.7	16.3
Program administration and net cost of insurance	0.5	0.6	1.1	1.7	2.8	4.7	4.0	7.5	9.2	12.8	14.5	19.1	21.9	24.8	29.2
Government public health activities	0.4	0.4	0.4	0.8	1.4	2.7	3.2	5.0	7.2	9.3	10.1	10.7	12.3	14.6	17.4
Research and construction of medical facilities	1.0	0.9	1.7	3.5	5.4	7.5	8.4	9.7	11.9	14.2	15.3	15.8	17.0	19.1	21.6
Research	0.1	0.2	0.7	1.5	2.0	2.8	3.3	4.4	5.4	5.9	6.2	6.8	7.8	8.9	10.1
Construction	0.8	0.7	1.0	2.0	3.4	4.7	5.1	5.3	6.5	8.3	9.1	9.0	9.2	10.2	11.5

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Table 12

National health expenditures average annual percent change, by type of expenditure: Selected periods 1950-90

Type of expenditure	1950-55	1955-60	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90	1965-84	1974-84	1978-84	1984-90	1984-86	1984-88	1986-88	1988-90
	Average annual percent change															
Total	7.0	8.7	9.2	12.3	12.1	13.3	11.0	8.9	12.4	12.8	12.6	8.7	8.3	8.7	9.0	8.8
Health services and supplies	7.6	8.3	8.7	12.6	12.3	13.7	11.3	9.0	12.7	13.1	12.9	8.8	8.5	8.8	9.1	8.9
Personal health care	7.6	8.6	8.6	12.8	12.4	13.3	11.0	9.1	12.6	12.9	12.6	8.9	8.6	8.9	9.3	9.0
Hospital care	8.9	9.0	9.0	14.9	13.4	14.1	10.6	8.6	13.6	13.4	12.9	8.2	7.0	7.9	8.7	8.9
Physicians' services	6.1	9.0	8.3	11.1	11.7	13.4	11.9	9.9	12.2	13.5	13.2	9.8	9.6	9.8	10.1	9.6
Dentists' services	9.4	5.6	7.3	11.1	11.6	13.3	12.5	8.5	12.2	13.0	13.4	9.0	10.6	9.9	9.1	7.2
Other professional services	7.3	8.9	3.7	9.1	10.4	16.5	11.7	10.4	11.9	14.7	13.4	10.6	11.5	11.1	10.7	9.7
Drugs and medical sundries	6.7	8.9	7.2	9.1	8.3	9.2	8.8	9.0	8.8	8.9	9.0	9.1	9.6	9.4	9.3	8.4
Eyeglasses and appliances	4.2	5.1	8.6	10.7	10.1	10.2	9.5	8.0	10.2	10.3	10.2	8.1	8.5	8.4	8.3	7.5
Nursing home care	10.8	11.0	31.5	17.8	16.4	15.2	11.7	9.7	15.5	14.2	13.4	9.8	10.2	10.0	9.9	9.4
Other health services	11.9	3.7	0.7	12.5	12.8	9.5	11.9	9.4	11.7	11.8	12.1	9.5	9.9	9.8	9.8	8.9
Program administration and net cost of insurance	14.6	6.7	15.1	10.1	7.2	18.3	17.3	7.3	13.4	15.2	16.7	7.4	7.2	6.8	6.4	8.5
Government public health activities	0.9	1.9	14.5	11.8	17.3	19.6	9.6	8.8	14.5	14.6	13.5	8.5	7.6	8.2	8.8	9.2
Research and construction of medical facilities	−2.2	14.7	15.0	9.0	9.2	7.3	6.4	5.8	8.2	7.8	8.3	5.4	3.9	4.9	5.9	6.4
Research	12.4	25.8	18.0	5.4	11.1	10.2	6.2	6.7	8.2	9.3	7.4	6.9	7.1	6.9	6.6	6.9
Construction	−5.0	10.0	13.8	11.4	8.1	5.1	6.7	5.1	8.2	6.7	9.0	4.2	1.4	3.3	5.3	6.0

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

can affect the system will cause a turnaround in the inpatient hospital utilization. The approach used in these projections follows this line of thinking. The estimates show a significant reduction in the rate of decline in utilization in 1986 and modest growth after 1988.

Community hospital outpatient

In contrast to the inpatient experience, outpatient care is growing strongly with average annual growth in expenditures from 1984 to 1990 projected to be twice as high as inpatient at 14.5 percent (Jensen and Miklovic, 1985). Growth in outpatient care makes sense in many respects. Some concern has been expressed that under Medicare's PPS, hospitals would admit patients, but shift as many services as possible to an outpatient setting, which is not covered by PPS, thus maximizing income from both settings. One of the factors that allows these shifts is that more technology has been adapted to the outpatient setting. Significant shifts to outpatient surgery have occurred, as well as the performance of many tests and medical workups formerly done on an inpatient basis (Anderson, 1985). In addition, many hospitals are expanding or reemphasizing their outpatient services by extensive marketing. These trends are consistent with government and business initiatives to have more services performed in a less costly setting.

As cost containment shortens stays and eliminates admissions, hospitals are seeking alternative sources of revenue and ways to employ their underutilized resources. Partial year data from the American Hospital Association Panel Survey, 1985 show outpatient visits to be growing at about a 3.7 percent rate in 1985, compared with a 1.6 percent average annual growth rate for the period 1978 to 1984. Many hospitals are aggressively marketing their outpatient services in forms to be competitive with HMO's, surgi-centers, emergi-centers, and the like.

Expenditures for outpatient care are predicted to be almost $46 billion by 1990, rising by an average annual growth rate of 14.5 percent from the 1984 level of more than $20 billion. Outpatient visits per capita for the same two periods grew at a 0.6 percent rate from 1978 to 1984, compared with a 2.0 percent rate from 1984 to 1990. Showing an opposite trend in growth rates, prices, after adjusting for overall inflation, dropped from 2.4 percent to 1.6 percent, and intensity per visit dropped from 5.2 percent to 4.7 percent. The net result is that even this strong growth is a decline from earlier periods such as 1978 to 1984 when expenditures grew at a 16.9 percent average annual rate.

Community hospitals maybe losing some business to nonhospital settings such as physicians' offices or surgi-centers and emergi-centers. In an attempt to offset these losses, one of the more recent initiatives in the hospital sector is the alliance between hospitals and insurers. In some cases, hospital chains are purchasing insurance companies, but in most cases major insurers and large hospital groups are uniting to create new kinds of competitive insurance packages. One example mentioned earlier is the MPPPO venture formed by the Voluntary Hospitals of America and Aetna Insurance Company. These alliances of providers and payers are attempts to lock in a set of clients to guarantee both partners a share of the market. Along these same lines, hospitals are also acquiring and setting up their own HMO's. Again, the attempt is to compete and maintain or increase a share of the market.

Federal hospitals

Federal hospitals spending is projected to experience slower growth than it has in the past, with expenditures rising from a 1984 level of less than $11 billion to more than $18 billion in 1990, a 7.9 percent rate of average annual increase. The rate of growth from 1978 to 1984 was 9.4 percent. The slow-down is attributed to Federal budget constraints, lower inflation rates, and Federal hospital closures. Federal hospitals are somewhat isolated from the forces affecting community hospitals because most are paid by appropriation rather than by reimbursement on a patient basis. Thus, they have not experienced as much of a slowing in growth as the community hospitals.

Other hospitals

The almost 800 non-Federal psychiatric, tuberculosis and other respiratory disease, chronic disease, and alcoholism and chemical-dependency hospitals that make up "other hospitals" are projected to grow at a 4.4 percent average annual rate from 1984 to 1990. Expenditures at these hospitals are estimated to be $12 billion in 1984 and to grow to more than $15 billion in 1990. Growth in the projected period is down slightly from the 1978 to 1984 growth of 5.3 percent, a difference accounted for by the estimate of lower inflation upon which these forecasts are predicated.

Physicians' services

Physicians have traditionally exerted far more influence on the health care sector than their 22-percent share of personal health care indicates. This is attributable to the fact that they are the primary decisionmakers in what kinds of health care patients receive, such as hospital care or drugs. However, although physicians' share of health care expenditures is growing, their role in decisionmaking may be lessening. The impact cost-containment policies such as second opinions means that often a single physician cannot decide a patient's course of treatment. But, the roots of the declines in physician influence go much deeper than the effects of second-opinion programs. Hospitals have been put under pressure by private and public cost-containment efforts. Previously, in an effort to attract and hold physicians, hospitals were

almost forced to acquire the newest and best of technologies and supplies. Now, they must face tighter budget constraints. An example of these constraints is the fixed-price prospective payment system under Medicare. Perhaps even more effective are private sector programs such as hospital bill audits, more cost sharing between the insurer and the insured, coordination of benefits, preferred provider organizations, and increased competition from HMO's. These programs put downward pressure on hospital revenue sources by reducing double or overpayments, discouraging hospital use, or conversely, by encouraging use in nonhospital settings, or requiring discounted prices.

Physicians now know that their practice privileges in an institution could be jeopardized if they are not cost efficient. Computer audits of patient stays, based on diagnosis, enable hospitals to identify physicians who tend to overutilize services. As hospital resources decrease, there will be increased competition among physicans for access to those resources. The result is that hospital administrators will play a much larger role in hospital management and, hence, physicians a lesser role (American Medical Association, 1985).

Expenditures for physicians' services are projected to grow at an annual average rate of 9.8 percent from the 1984 level of more than $75 billion, reaching almost $132 billion by 1990. The growth rate from 1978 to 1984 was 13.2 percent. The slower projected growth rate is a result of many factors, including lower average inflation during the projection period than from 1978 to 1984. Competition from hospital outpatient departments may also limit the growth in expenditures for physicians' services. How the decline in inpatient hospital use will affect physicians is still to be seen. To the extent that physicians' services are complementary to hospital care, one would expect physicians' services to be restrained; to the extent that physicians' services can substitute for inpatient care, a physician's role in health care delivery may grow. In the projection presented here, the physician portion of personal health services is projected to increase slightly from a 1984 share of 22.1 percent to a 1990 level of 23.2 percent. Per capita expenditures for physician care are projected to increase from $307 in 1984 to $510 in 1990. The average annual growth rate for the period 1984 to 1990 is 8.8 percent, down from 12.1 percent for the period 1978-84.

Dentists' services

After years of reasonably strong growth, dental expenditures are projected to moderate somewhat, remaining at an essentially constant percent of total personal health care. Amalgam sales, after adjusting for the price of silver, are down in the current period. This suggests a decline in restorative work because of the combined effects of improved dental hygiene, fluoridation, and a slackening in the growth in insurance coverage for dental care (Bureau of Labor Statistics, 1985). With regard to the latter, many employees gave up dental and vision benefits during the recession period in exchange for wages. This phenomenon was particularly true in the heavy industries, where emphasis has shifted from maintaining fringe benefits to keeping jobs. In addition, many dental plans have added or increased deductibles and coinsurance.

Dental expenditures are estimated to be $25 billion in 1984 and are projected to be $42 billion by 1990. The annual average growth rate in dental expenditures for the period 1984 to 1990 is projected to be 9.0 percent, compared with the 13.4 percent rate from 1978 to 1984. The lower rate is reflected in all five projection factors, but moderation of economy-wide inflation has the most impact on the slowing of the rate of increase in dental expenditures.

Other professional services

Other professional services include the services of freestanding home health agencies (HHA's), optometrists, podiatrists, chiropractors, private duty nurses, occupational, speech, and physical therapists, clinical psychologists, and others who are engaged in independent practice. In 1990, a projected $16 billion will be expended on the services of these other professionals, almost double the 1984 level of less than $9 billion. These services are projected to experience a faster rate of growth than most other personal health services, although the growth from 1984 to 1990 is 10.6 percent compared with a growth of 13.4 percent from 1978 to 1984 because of lower projected overall price levels. As this category includes nonhospital-based home health agencies, one might expect increasing rates of growth in the projected period as is also projected for other substitutes for hospital inpatient care. However, a significant portion of home health agency growth is hospital based and is included in expenditures for hospital care.

Drugs and medical sundries

Drugs and medical sundries dispensed through retail channels are projected to grow from 1984 level of less than $26 billion dollars to a 1990 level of almost $44 billion. Drug prices are projected to grow slightly faster than economy-wide prices. This forecast is consistent with reports that new and expensive drugs are being developed, including biogenetically created drugs (Business Week, 1985).

Eyeglasses and appliances

After a surge of purchases following the recent recession, expenditures for eyeglasses and appliances are projected to grow at an average annual rate of 8.1 percent from 1984 to 1990. The 1984 expenditure level for this category (more formally and perhaps descriptively named ophthalmic products, orthopedic appliances, and durable medical equipment) is more than $7 billion. The projected 1990 level is $12 billion. Although ophthalmic products comprise the majority

of these expenditures, durable medical equipment is an area where more future growth may occur. The rationale for this speculation is based on the notion that earlier discharges from or nonadmission into hospitals may cause significant increases in the amount of self or family health care. This will result in the purchase of more durable medical equipment and supplies.

Nursing home care

Nursing homes, including intermediate care facilities for the mentally retarded is the third largest component of personal health care (after hospitals and physicians). Nursing home care, along with physician expenditures, are the only significant categories of personal health care expected to increase as a share of the total (Table 6). Nursing home care expenditures are projected to be more than $56 billion in 1990, growing at an average annual rate of 9.8 percent from the 1984 level of $32 billion. The average annual growth rate from 1978 to 1984 is 13.4 percent. The nursing home growth, which is strong in relation to the growth rate projected for most other components of personal health care, is supported by demographic shifts towards the elderly and especially the extremely elderly. Also, as with home health care, some expenditures for nursing home care will be precipitated by the shorter hospital stays expected under continued cost-containment efforts.

Other personal health care

The other health services category consists primarily of care provided in Federal units other than hospitals, school health services, and industrial in-plant services. This category is projected to account for more than $16 billion in expenditures in 1990, compared with a 1984 level of more than $9 billion, an average annual growth rate of 9.5 percent per annum.

Program administration and net cost of health insurance

Expenses for program administration and net cost of health insurance include the administrative costs of public programs and private voluntary health organizations for lobbying, fundraising, and similar activities. It also includes the difference between private health insurance benefits and premiums, that is, the net cost of purchasing health insurance. The total for this category will rise from $19 billion dollars in 1984 to a projected level of more than $29 billion in 1990. Insurance comprised 70.2 percent of the 1984 total for program administration and net cost of insurance and is projected to be 71.4 percent in 1990. Nevertheless, growth in this category and especially in insurance has slowed considerably because of competition in the insurance industry and increased awareness on the part of employee benefit specialists. This trend should continue as employers become purchasers of health care instead of payers and as the options available to them, such as PPO's and HMO's, continue to expand.

Government public health activities

The current budgetary constraints and concerns are having a considerable impact on expenditures for public health. State and local expenditures account for almost 90 percent of these activities. Their expenditures will grow at an average annual rate of 9.1 percent from 1984 to 1990, at less than one-half the 18.7 percent growth rate from 1974 to 1984. The 1990 level for public health is projected to be more than $17 billion, which is still a considerable increase over the almost $11 billion level in 1984.

Research

Research is another area affected by budget considerations, although it may not be to the same extent as public health. One factor supporting increases in research is public concern over a variety of diseases, such as cancer and acquired immune deficiency syndrome (AIDS). Federal research comprises about 85 percent of the total and has, on average, grown at a constant 7.5-percent rate. Overall research expenditures are projected to grow from a 1984 level of a little less than $7 billion to a 1990 level of $10 billion, a 6.9 percent average annual rate of growth.

Construction of medical facilities

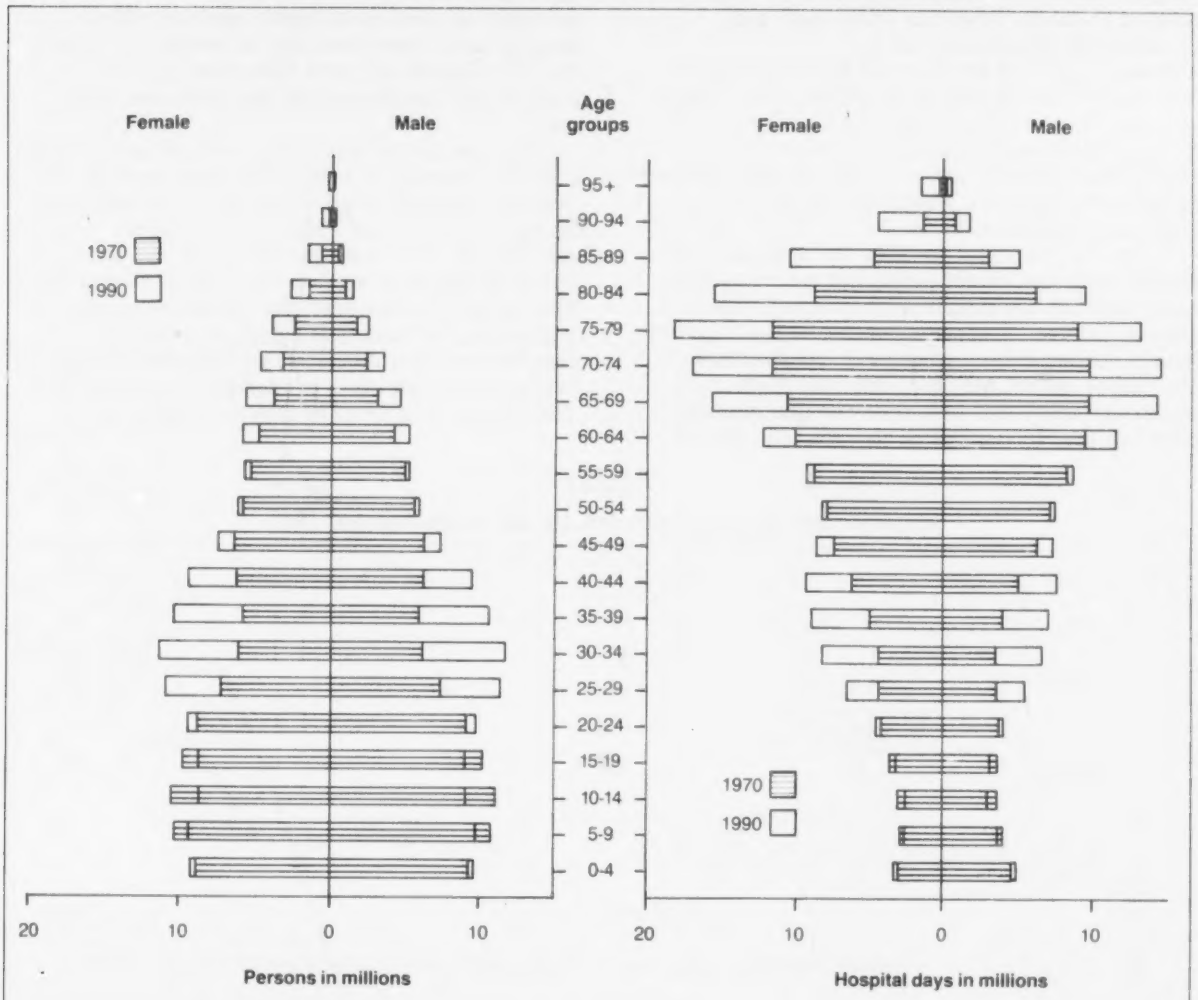
As might be expected from the declines in utilization, budget constraints, and general uncertainty, growth in construction has slowed to a pace consistent with replacement needs. These declines reflect reductions in hospital building. Construction of nursing homes and other less expensive facilities are continuing to grow (Punch, 1985). The rate of private construction, which represents 70 percent of the total, declines from an 11.8 percent growth from 1978 to 1984 to a projected 4.4 percent growth from 1984 to 1990. The change for construction for the last historical year was −1.9 percent. The projections in the out-years represent an assumption of a return to more normal growth patterns.

Demographics of health expenditures

In the past, the projections have implicitly recognized the effects of population aging in the selection of forecast assumptions, considering the work of several researchers. Analyses are now being prepared to explicitly recognize the effects of changes in age structure on average use and average price per service. Some preliminary results of these studies are summarized here. The U.S. population in 1970 and 1990 and the corresponding number of hospital days of care are charted in the typical format of a

Figure 1

Population and days of hospital care, by age and sex: 1970 and 1990



[1]Hospital days, which exclude maternity and newborn use, are based on per capita experience.

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

population pyramid (Figure 1). The hospital days, which exclude maternity and newborn utilization, are based on the per capita experience reported in the National Hospital Discharge Survey (NHDS) of 1981. The shape of the population pyramid is determined largely by the fertility history of the United States and the mortality patterns by age and sex. Of particular importance to this analysis are the indentations corresponding to the low birth rates of the 1930's depression, the bulge of the post-World War II baby boom, followed by the baby bust of the 1970's. These demographic features will influence demand for medical services into the next century.

The area under the population pyramid represents total population, and the area under the hospital utilization pyramid represents total hospital days of care used per year. Although the areas are roughly equal, the distribution by age is almost exactly reversed. As the proportion of the population in the older age groups increase from 1970 to 1990, the effects on utilization are magnified by the sharply higher use of services among the aged. This is the phenomenon of the effect of aging on the demand for medical care. The effects of aging depend on the relative use of services by age. Because hospital use generally increases with age, population aging tends to drive up hospital use faster than the growth in population. For services where use declines with age, such as dentistry, use will tend to increase more slowly than population growth.

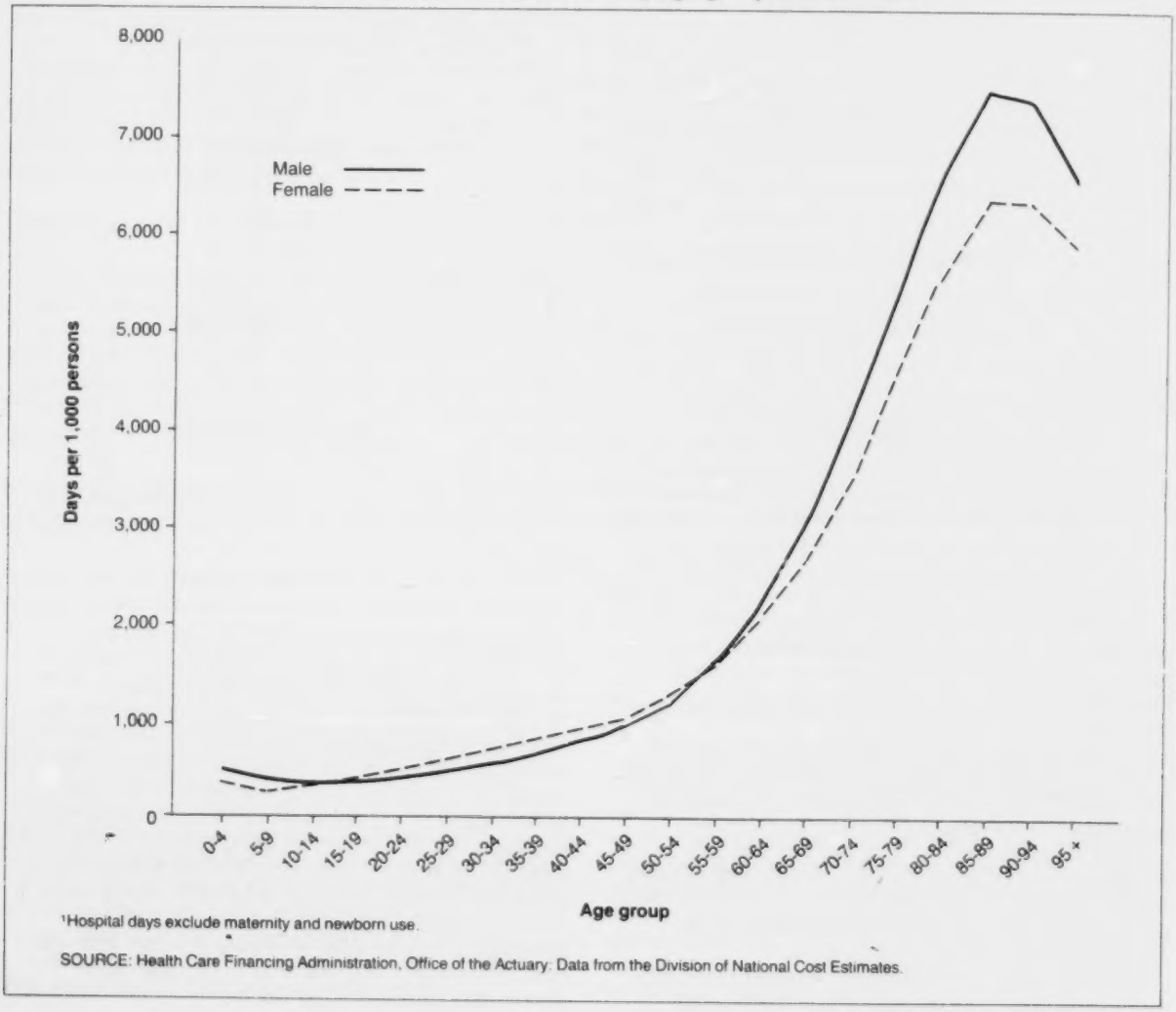
Actual utilization patterns by age and sex are shown for five commonly used services (Figure 2 through 6). Hospital utilization is from the NHDS of 1981 referred to earlier. Physician office visits and prescribed drug utilization for the noninstitutionalized are from the National Medical Care Expenditure Survey (NMCES) of 1977. Dental visits are from the Health Interview Survey of 1981. Nursing home residency rates were taken from the 1980 census. All rates except nursing homes have been smoothed by using the Whittaker-Henderson graduation technique.

Except for the dental services, use rates generally increase with age, except perhaps at the very oldest ages. Although the sample sizes are usually small at extreme old ages, it appears that use of most services (except nursing homes) plateaus or even decreases after about age 85. Medicare data also suggest a similar pattern. It has been observed that mortality rates also tend to stabilize at very old ages, perhaps because survival to these ages produces a super select population. Utilization is also very different by sex. The higher use of nursing homes by older females is probably not because of higher morbidity (their hospital use is lower than that of males) but to the fact that females are more likely than males to be alone at old ages because of their lower mortality rates.

Prices per unit of service also vary by age and sex (Figures 7 through 11). Hospital costs are from the National Medical Care Utilization and Expenditure Survey (NMCUES) of 1980. Nursing home charges are from the 1977 National Nursing Home Survey. Prices for the other services are from NMCES (1977). Most prices per measured unit increase with age augmenting the impact of aging on utilization. Hospital costs per day, however, decrease with age because the longer stays of the aged spread out costs. This somewhat offsets the effects of aging.

Figure 2

Hospital days[1] per 1,000 persons, by age group and sex: 1981

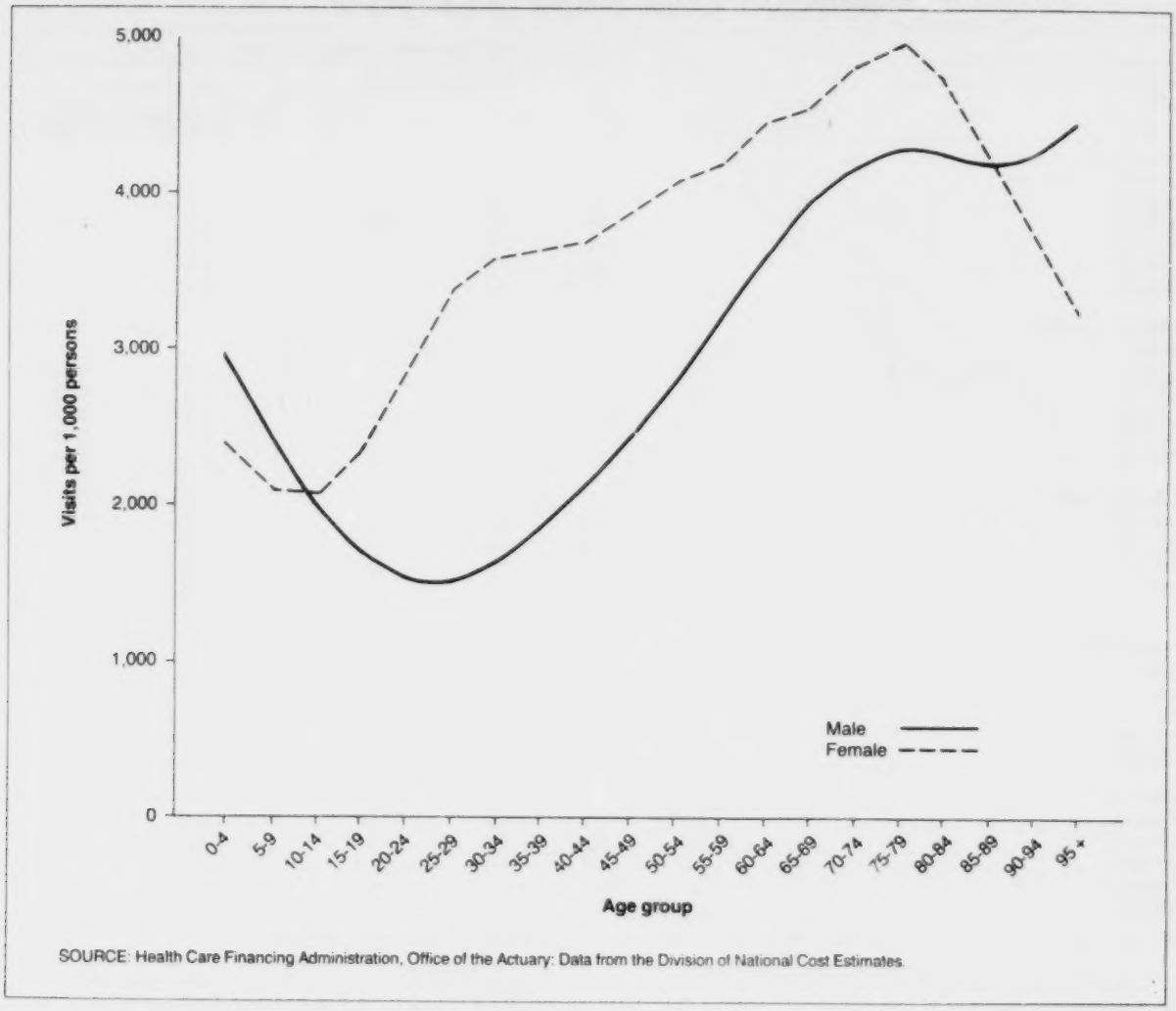


[1]Hospital days exclude maternity and newborn use.

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Figure 3

Physician office visits per 1,000 noninstitutionalized persons, by age group and sex: 1977



SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

The effects of changes in population composition on aggregate utilization rates were calculated by multiplying a fixed set of age-sex specific utilization rates by population in each group for each year from 1965 to 1990. The population data and projections were provided by the Office of the Actuary of the Social Security Administration (Wade, 1985). The methodology is essentially the same as used by several other researchers (Russell, 1981). The average aggregate use per capita was then computed for each year. The result shows changes generated solely by population mix, exclusive of population growth (Table 13).

During the period 1965-90, the demographic component of change in use is much more stable than the change in total use. The medical care system underwent major perturbations in this period, especially the introduction of Medicare and Medicaid in the mid-sixties. For most services, the effect of aging is stronger for females than for males because of lower female mortality. In the 65 years of age or over group, the effects of aging dropped to a minimum during the period 1975 to 1980 because the relatively large pre-depression birth cohort was just turning 65, holding down the increase in the average age among the elderly. As that cohort ages and the small birth cohort of the depression turns 65 about 1995, the effects of aging in the over age 65 group will accelerate.

The distinctive feature of the under 65 years of age population is the bulge from the baby boom which peaked about 1960. As that population started entering early adulthood in about 1980, the demographic influence on hospital and physician services started to rise. The most dramatic upturn is expected early in the next century as this cohort approaches the steeper portion of the utilization curves.

Table 13

National health expenditures average annual change per capita, by type of service and demographic factors: Selected periods 1965-90

Type of service and period	Actual change	Demographically induced change					
		Utilization change					Price change
		Total	Male	Female	Under age 65	Age 65 or over	
Hospital days (excluding maternity)							
1965-70	1.9	0.4	0.2	0.7	0.1	0.5	.01
1970-75	0.0	0.6	0.4	0.8	0.1	0.1	-.06
1975-80	0.8	0.7	0.5	0.8	0.3	0.1	-.10
1980-85	-4.6	0.7	0.5	0.8	0.2	0.2	-.15
1985-90	-1.6	0.7	0.6	0.7	0.2	0.3	-.14
Physician office visits							
1965-70	0.4	0.0	-0.2	0.1	0.0	0.0	0.14
1970-75	2.7	0.1	-0.2	0.3	0.0	0.0	0.19
1975-80	-1.2	0.2	-0.1	0.3	0.1	0.0	0.17
1980-85	-1.0	0.2	0.1	0.2	0.1	0.0	0.09
1985-90	-0.2	0.2	0.2	0.2	0.1	0.0	0.08
Nursing home days							
1965-70	9.3	2.2	1.1	2.8	0.5	1.9	—
1970-75	4.9	2.0	1.0	2.4	0.4	0.9	—
1975-80	2.4	1.8	1.0	2.1	0.3	0.7	—
1980-85	1.6	1.8	1.1	2.1	0.1	0.8	—
1985-90	1.4	2.0	1.5	2.2	-0.1	0.9	—
Prescriptions							
1965-70	—	0.2	-0.1	0.3	0.0	0.1	0.05
1970-75	—	0.3	0.0	0.4	0.1	0.0	0.06
1975-80	—	0.4	0.1	0.5	0.2	0.0	0.05
1980-85	—	0.3	0.3	0.4	0.2	0.0	0.03
1985-90	—	0.4	0.4	0.4	0.2	0.0	0.05
Dentists							
1965-70	-0.8	0.2	0.2	0.2	0.3	-0.1	0.10
1970-75	1.4	0.2	0.1	0.2	0.2	0.0	0.13
1975-80	0.5	0.0	0.0	0.0	0.0	-0.1	0.11
1980-85	0.9	-0.1	-0.1	-0.1	-0.1	-0.1	0.05
1985-90	0.2	-0.1	0.0	-0.1	0.0	-0.1	0.05

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

This preliminary analysis is a prelude to expanding the five-factor model to seven factors in order to quantify the portion of utilization and price change that have been produced because of demographic effects. In the past two decades, that effect has been relatively small except for nursing home services. In the relatively near future, it is expected to increase rapidly and become a more important element of analyses of expenditure trends. Long-term projections would be meaningless unless population mixes were considered.

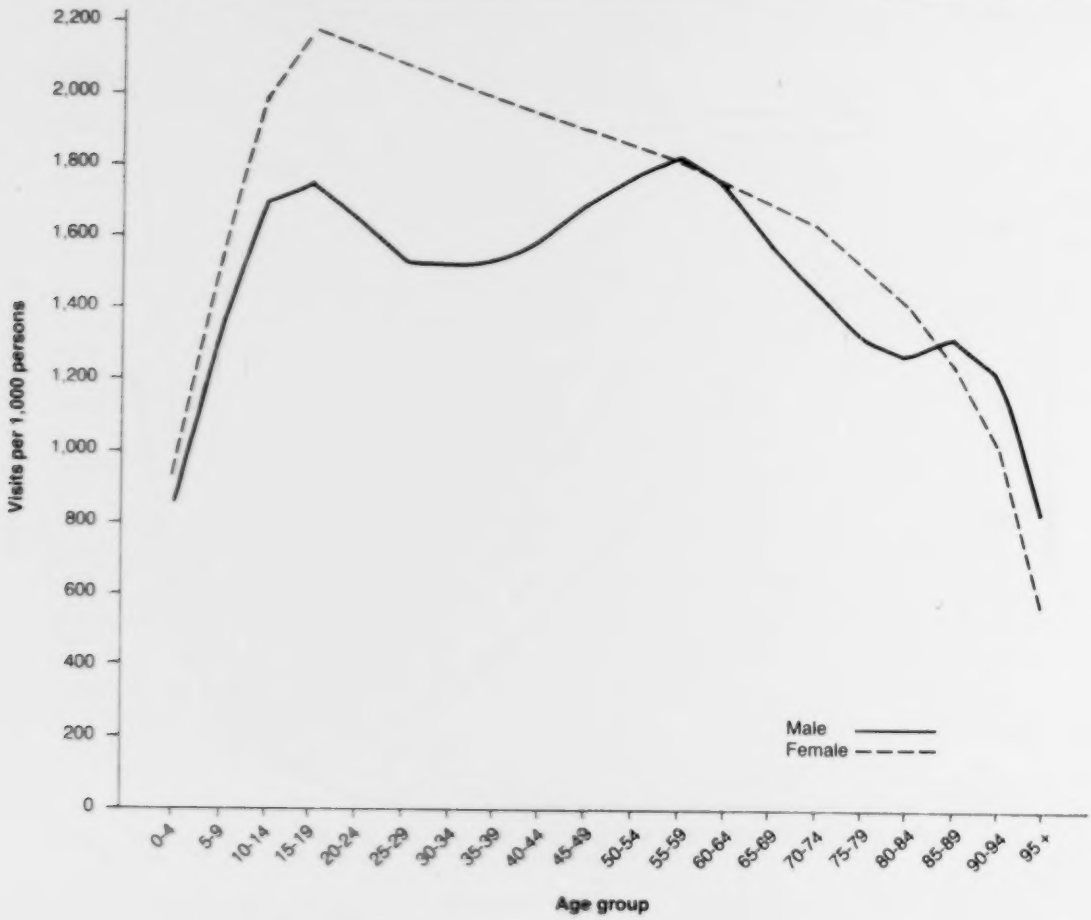
Projection methodology

The projection model provides a framework that includes economic, actuarial, statistical, demographic, and judgmental factors. A relatively simple and intuitive model was developed to project expenditures for each type of service, such as, hospital care, physicians' services, and nursing home care, and sources of payment for these expenditures, for example, out-of-pocket expenses, the Federal Government, and State and local governments (Levit et al., 1985). Expenditures and sources of funds for each type of expenditure are aggregated to produce national health expenditures.

The projection model incorporates projections from the Board of Trustees 1985 Annual Reports (population, implicit price deflator for GNP, gross national product, and Medicare outlays by type of service). Aggregate Federal Medicaid outlays are derived from Health Care Financing Administration (HCFA) projections from the Midsession Review of the 1986 Budget. Health manpower projections made by the Bureau of Health Professions (Health Resources and Services Administration, 1985) are included in the projection model.

Figure 4

Dental visits per 1,000 persons, by age group and sex: 1981



SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

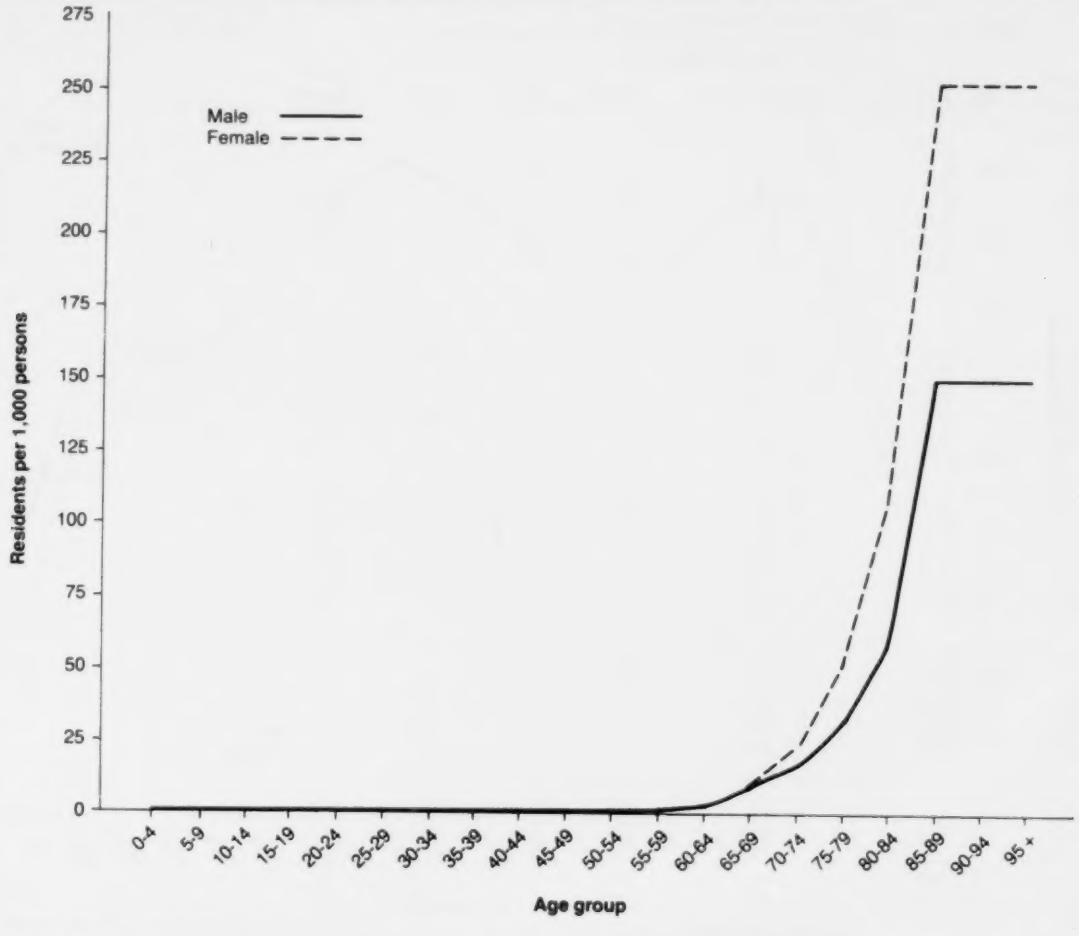
All other projections are based on trends and relationships observed in the historical time-series data and on special condition assumptions applicable for particular sectors of the health care industry.

The projection model has four components: (1) a five-factor module for specific types of expenditures (such as physicians' services),[2] (2) supply variables (such as the number of physicians and the number of nursing home beds), (3) a channel of finance module for eight sources of funds, and (4) a net cost of private health insurance and program administration cost module. Interaction and consistency among these four components are essential features of the projection process.

[2]The effects of the other three components of the projection model (supply variables, sources of funds, and net cost of private health insurance and program administration cost) are reflected in the five-factor module.

Figure 5

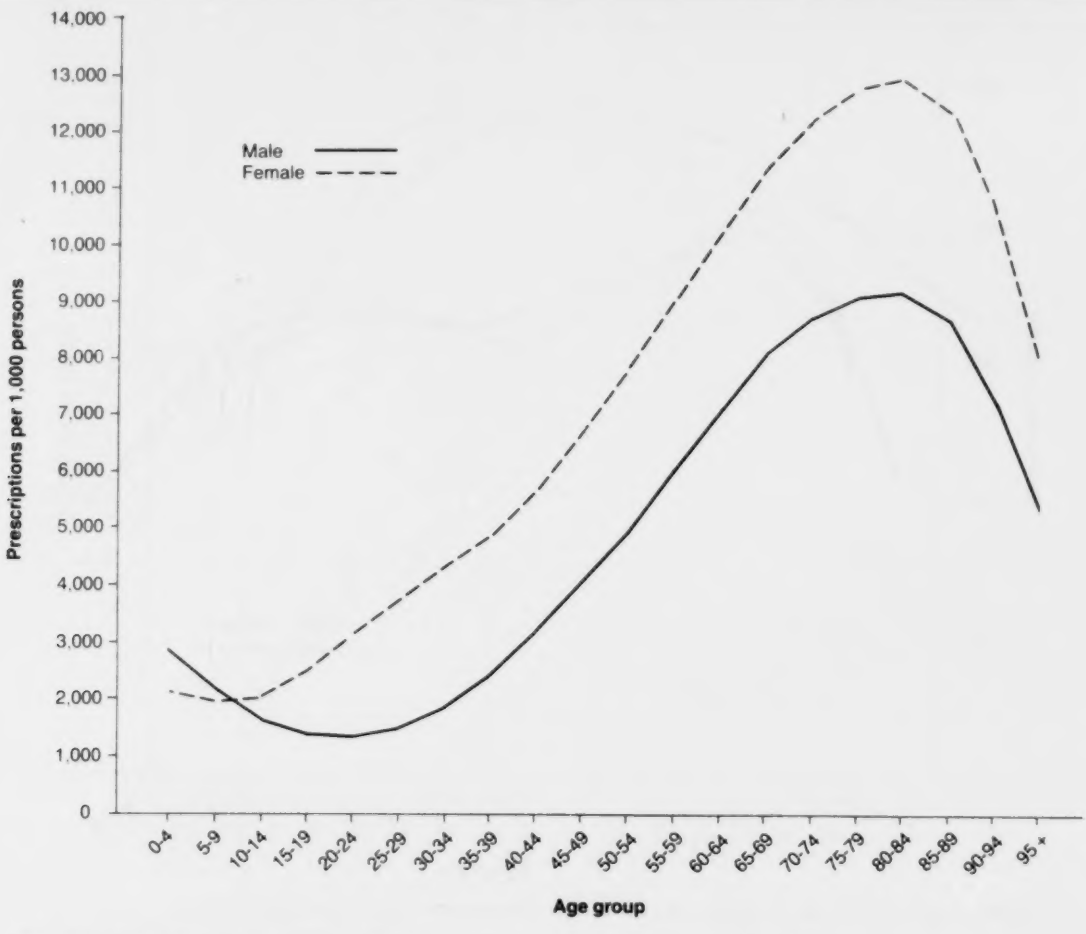
Number of nursing home residents per 1,000 persons, by age group and sex: 1980



SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Figure 6

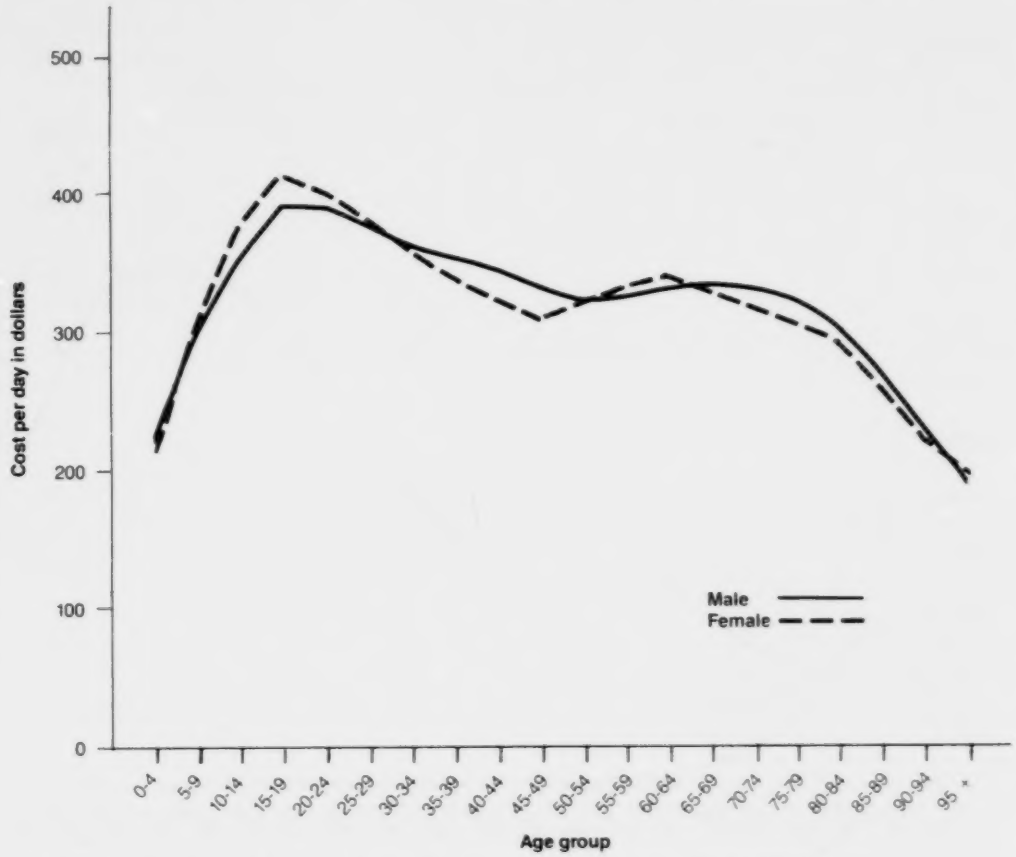
Number of prescriptions per 1,000 noninstitutionalized persons, by age group and sex: 1977



SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Figure 7

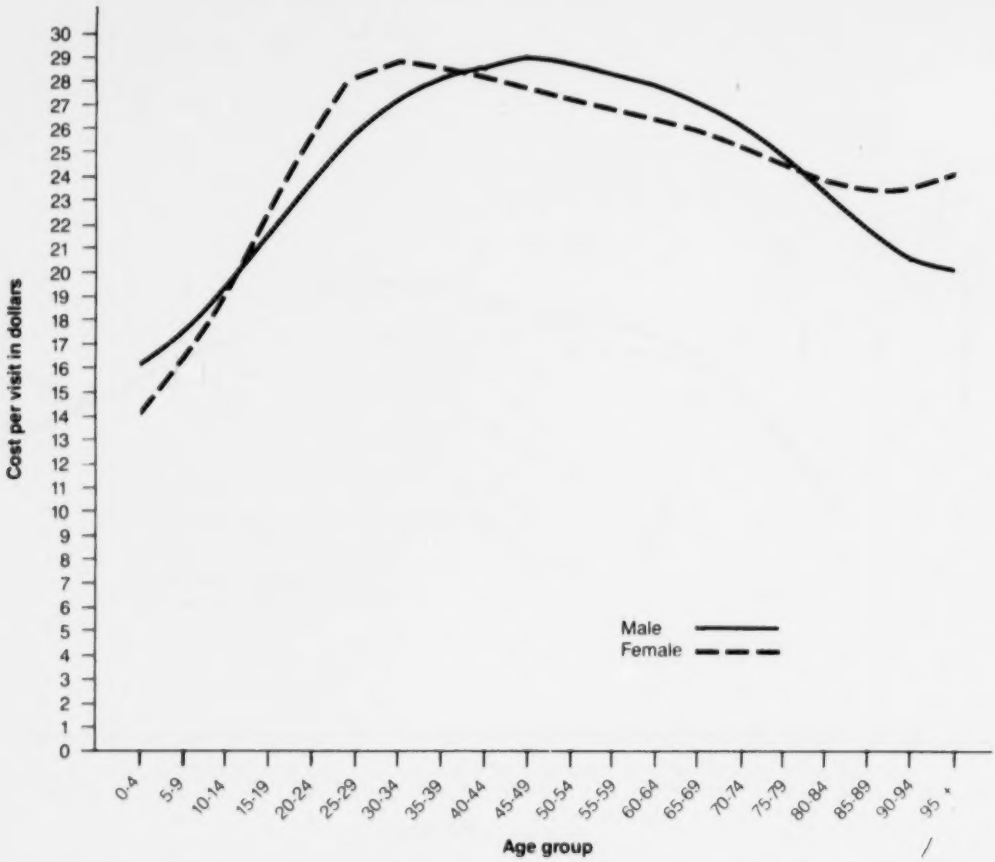
Hospital cost per day, by age group and sex: 1980



SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Figure 8

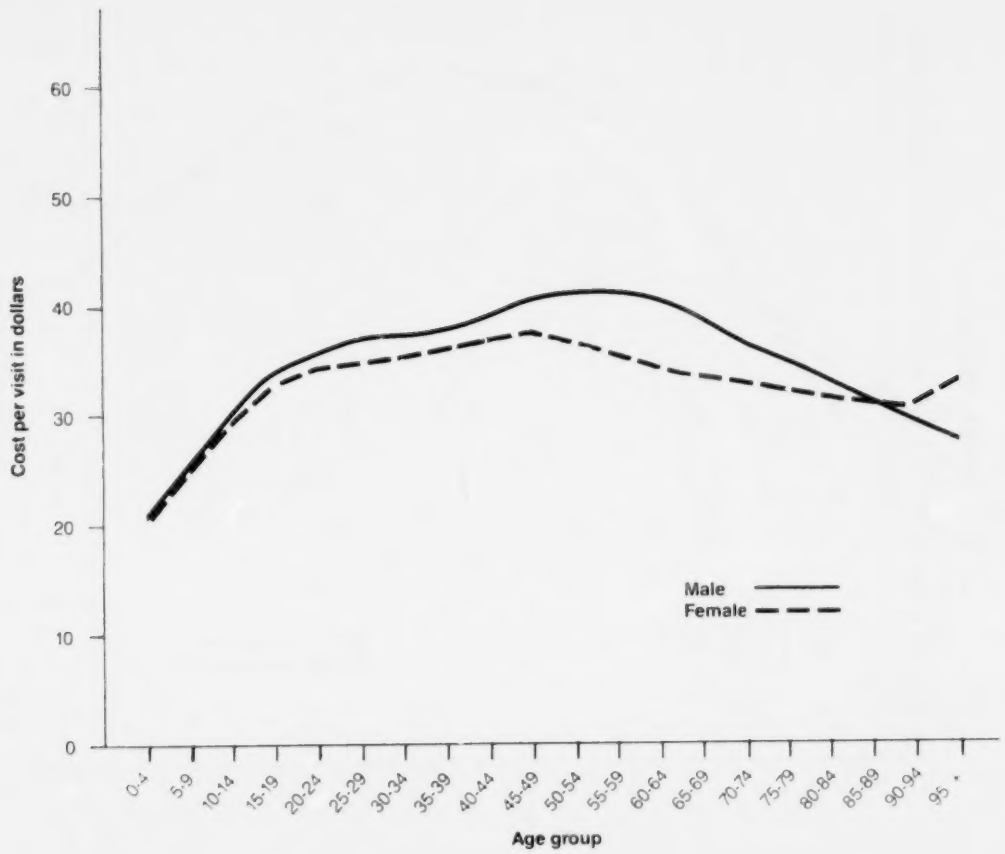
Cost per physician office visit, by age group and sex: 1977



SOURCE: Health Care Financing Administration, Office of the Actuary. Data from the Division of National Cost Estimates.

Figure 9

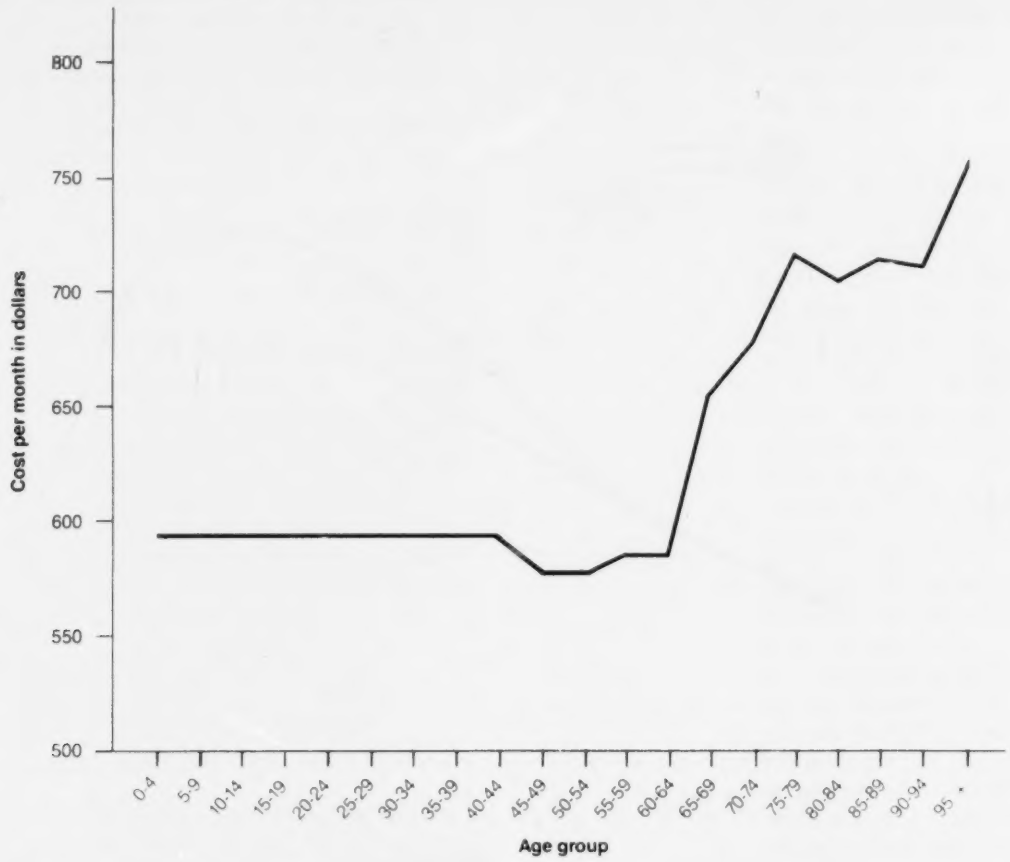
Cost per dental visit, by age group and sex: 1977



SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

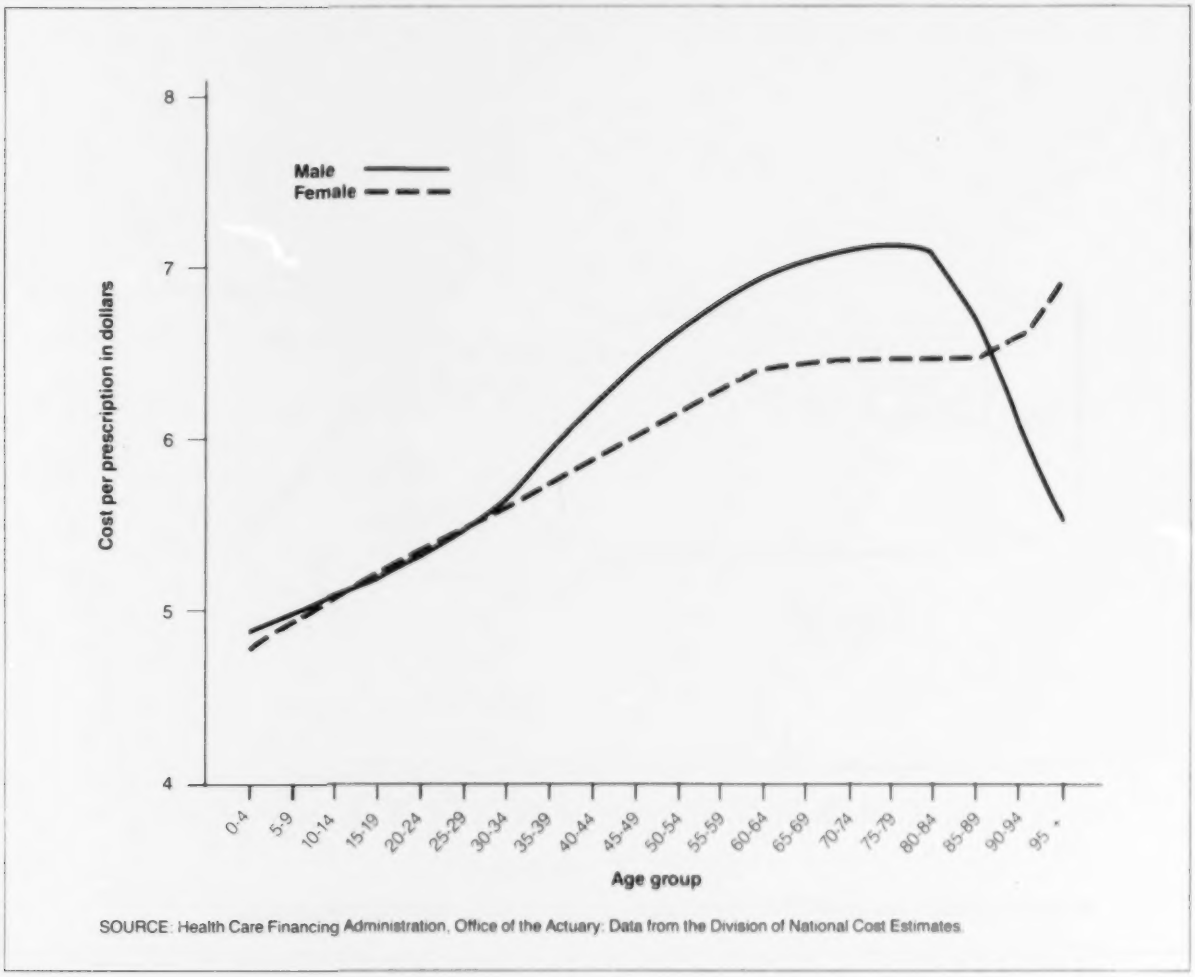
Figure 10

Nursing home cost per month, by age group: 1977



SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Figure 11
Cost per prescription, by age group and sex: 1977



SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Five-factor module

An equation with five factors is used to project each expenditure type. The five factors are total population, use per capita (vistis per capita, patient days per capita), the GNP deflator, medical care prices relative to the GNP deflator, and a residual category, real expense per unit of service. This last factor reflects use per unit of service.

The equation is solved sequentially for each year in the projected period:

$$EXP_{it} = EXP_{it-1}(1 + \%CH(POP_t)(1 + \%CH\left(\frac{UTIL}{POP}\right)_{it})(1 + \%CH(PGNP_t))$$

$$(1 + \%CH\left(\frac{MEDPRICE}{PGNP}\right)_{it})(1 + \%CH(RESIDUAL_{it}))$$

EXP_{it} is the projected level of health expenditure of type "i" in year "t" (for example, the level of expenditures for physicians' services in 1985, the first year of projected values).

EXP_{it-1} is the level of health expenditure for type "i" for year "t-1." This is an historical value for calendar year 1984 and a projected value thereafter. Historical expenditures are from the Health Care Financing Administration (Levit et al., 1985).

$\%CH(POP_t)$ is the projected annual percent change, divided by 100, of total population for year "t" compared to year "t-1." For example, population was projected to grow from 245,226 (in thousands) in 1984 to 247,424 in 1985, an increase of 0.90 percent (247,424/245,226 = 1.009). POP_{1985} is .009 and the first term in parentheses of the five-factor equation for E_{1985} is 1.009.

Shifts in the demographic mix (for example, toward more aged persons) that affect utilization growth rates are factored into the next variable, growth in use per capita.

$\%CH\left(\frac{UTIL}{POP}\right)_{it}$ is the projected annual percent change, divided by 100, of per capita use of medical service type "i" in year "t," where use is measured by patient visits per capita, patient days per capita, or some similar measure.

$\%CH(PGNP_t)$ is the projected annual percent change, divided by 100, of the implicit price deflator for GNP for year "t." Growth in the GNP deflator reflects economy-wide cost pressures that are external to the health care industry.

$\%CH\left(\frac{MEDPRICE}{PGNP}\right)_{it}$ is the projected annual percent change, divided by 100, of medical care price for service type "i" in year "t" deflated by the implicit price deflator for GNP for year "t." This measures change in medical care prices relative to overall prices in the economy. It captures the implicit underlying interplay of (1) demand-pull inflationary forces (such as changes in deductibles and coinsurance), (2) cost pressures specific to the industry, (3) supply-side pricing behavior, (4) supply-side productivity behavior, and so on.

$\%CH(RESIDUAL_{it})$ is the projected annual percent change, divided by 100, of the residual category for service type "i" for year "t." This factor can be interpreted as the percent changes in real expenditures per unit of service, such as per physician visit or per hospital day. This factor includes changes in the number of diagnostic and therapeutic procedures provided per visit or inpatient day, changes in the mix of services, and changes in regulations that impact on the quantity and quality of resources used to produce a visit or patient day. Like all residuals, it is an amalgamation of effects that cannot be individually measured or differentiated. Because the measures of price used are imperfect, this category should be interpreted with caution. For example, errors in the price change variable get translated into compensating errors in the movement of the residual category.

Although the general model accounts for five factors, models for some types of expenditure have four factors because of irrelevance or lack of data. In these instances, growth rates for use per capita and real expense per unit of service are combined into one residual category, growth in real expenditures per capita. The combined effects of the five factors are multiplied to obtain a composite annual rate of expenditure growth for each type of expenditure for each year in the projected period.

Numerous data sources were used to factor individual types of expenditures into the three components specific to the health sector (use per capita, medical care prices relative to overall prices in the economy, and real expenses per unit of service). Growth rates from 1985 to 1990 for these factors are based on historical relationships and trends.

Annual percent changes and average annual growth rates were studied for selected sub-periods between 1965 and 1984. Certain sub-periods were considered irrelevant because they were affected by unique forces not expected to be repeated (for example, the initial impact of Medicare or the Economic Stabilization Program (ESP) on prices and use of services).

In general, medical care prices increase faster than the GNP deflator. During periods of high growth in commodity and energy prices, the diffential between medical care prices and economy-wide prices usually narrows. In addition, when overall price increases in the economy decelerate, increases in medical care price typically decelerate with a marked lag.

Growth rates in use per capita and real expense per unit of service may be influenced by shifts in the age-sex distribution of the population, and by changes in the proportion of expenses funded by third parties, health manpower, real income, and regulation of the health sector. Growth rates for use per capita and real expenses per unit of service were examined together, because one may offset the other. Years of abnormally high growth in visits per capita, for example, may be associated with years of abnormally low growth in real expense per visit, and vice-versa.

Taking the above considerations into account, year-to-year growth rates from 1985 to 1990 were projected for medical care prices relative to the implicit price deflator for GNP, use per capita, and real expenses per unit of service.

The product of the growth rates for these factors and the projected growth rates for total population and the implicit price deflator for GNP, yield yearly expenditure growth rates for each type of service for the projected period. Expenditure levels are derived by multiplying the projected expenditure growth rates times the prior year's expenditure level. This is an historical value for 1984 and a projected value thereafter. Projected yearly totals of national health expenditures are calculated by summing all expenditure types.

Projection of selected supply variables

Selected supply variables are projected simultaneously with the process just discussed (the five-factor projection module). In some cases, supply projections were taken from specialists in those areas.

Projections of the number of active medical doctors (M.D.'s), doctors of osteopathy (D.O.'s), and dentists are obtained from the Bureau of Health Professions within the Department of Health and Human Services. Projections of non-Federal, office-based M.D.'s, D.O.'s, and dentists are then made by the Health Care Financing Administration, based on historical relationships between active physicians and dentists and non-Federal, office-based practitioners.

Revenues and real output per non-Federal, office-based physician and dentist are projected simultaneously with the projection of expenditures for services of physicians and dentists by using the five-factor methods. Growth in the number of visits, real expenditures per visit, and medical care prices relative to the GNP deflator are iteratively adjusted until reasonableness based on historical trends and relationships is obtained for both the five-factor module and the revenues and real output per physician and dentist sectors.

The number of community hospital, Federal hospital, and nursing home beds and occupancy rates are projected simultaneously with patient days to reflect judgments relating to the interplay of patient demand (involving such factors as: demographics, insurance, and real income), regulations pertaining to new construction, credit costs, and credit availability.

Projection of sources of funds

For each type of expenditure, the channel of finance module projects eight sources of funds: (1) direct or out-of-pocket payments, (2) private health insurance, (3) spending by philanthropic organizations, industrial in-plant health services (for example, an onsite nurse), and privately financed construction, (4) Medicare, (5) Federal Medicaid, (6) other Federal, (7) State and local Medicaid, and (8) other State and local (Levit et al., 1985). Medicare actuarial projections of Medicare benefit outlays used the same assumptions for overall inflation, GNP, and so forth, that were used for these national health expenditure projections. Growth in aggregate Federal Medicaid benefit outlays is consistent with HCFA budget projections.

Projections for all other sources of funds are based on historical trends modified to account for expected changes in the third-party reimbursement system. Amounts derived from the channel of finance and the five-factor modules were adjusted for consistency and reasonableness.

Program administration, insurance net cost

Expenses for program administration and net cost of private insurance include three components: (1) administrative expenses of government-financed programs, (2) nonpersonal health expenditures of private voluntary health organizations for health education, lobbying, fundraising, etc. (Levit et al., 1985), and (3) net cost of private health insurance organizations (Blue Cross and Blue Shield Associations, commercial insurance companies, and independent plans).

Administrative expenses for Medicare were projected as part of the Board of Trustees Annual Reports (1985). Growth in administrative expenses for Medicaid are consistent with the HCFA budget projections. Administrative expenses for other programs were projected in accordance with historical trends and relationships.

For private health insurance organizations, net cost reflects the difference between earned premiums (or subscription income) and incurred benefit payments (claims). This amount is retained by private health insurance organizations for operating expenses, additions to reserves, and profits.

Private health insurance benefit payments are projected in the channel of finance module (discussed earlier) for each type of service (e.g., hospital care and physicians' services) for each year. The aggregate of projected insurance benefits is then allocated to Blue Cross and Blue Shield Associations, commercial insurance companies, and independent plans, based on projected trends in relative market shares. Finally, premiums (or subscription income) are projected for Blue Cross and Blue Shield Associations, commercial insurance companies, and independent plans by using load factors to cover operating expenses, additions to reserves, and profits. The net cost of insurance is computed by subtracting the projected total benefit payments from the total premiums.

Table 14

Relative proportion of factors accounting for growth: 1974-84

Factors accounting for growth	Average annual rate of growth 1974-84	Relative proportion[1]
	Percent	
Total	13.4	100.0
GNP implicit price deflator	6.9	51.5
Population	1.0	7.5
Admissions per capita	−0.1	−0.8
Intensity per admission	3.4	25.4
Medical care prices	2.2	16.4

[1]The average annual rate of growth for each factor divided by the total.

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of National Cost Estimates.

Factors accounting for growth

The average annual growth rate for the period 1974 to 1984 was computed for each of the five factors accounting for the growth of selected categories of national health expenditures (Table 14). Only four factors were used for categories such as total personal health care where use per capita is not applicable. The rates of growth in the five factors are added together to produce a total for each type of service representing 100 percent of the growth of the category during the period. Negative growth rates resulting from declines in use per capital in the hospital and physician categories are included to demonstrate their negative impact on total growth. Each factor is then divided by the total to compute the relative contribution of that component to total growth. The same procedure is used to compute the relative proportions of the three factors (use per capita, intensity, and health care prices) that account for sector-specific costs.

Acknowledgments

We wish to thank Mark S. Freeland, Ph.D., for his guidance in the projections process. Dr. Freeland is on sabbatical on a Pew Fellowship for a year at the University of California at San Francisco, Institute for Health Policy Studies. We are indebted to Lawrence Schmid, Office of the Actuary, for developing and performing computer analyses of the demographic data. We also wish to thank George I. Kowalczyk, Director of the Division of National Cost Estimates; Roland E. King, Fellow of the Society of Actuaries and Chief Actuary for the Health Care Financing Administration; and Gordon R. Trapnell, Fellow of the Society of Actuaries, Actuarial Research Corporation, Annandale, Virginia, for their contributions to this effort. Detailed critiques of the article and the projections were made by Katharine R. Levit, Daniel R. Waldo, Helen Lazenby, and George Chulis, all of the Division of National Cost Estimates; Charles R. Fisher, Director of the Division of Information Analysis, and Mark R. Meiners, Ph.D., of the National Center for Health Services Research. We are grateful to Carol Pearson for administrative assistance.

References

American Hospital Association, National Hospital Panel Survey. Chicago, 1985.

American Medical Association: *The Environment of Medicine*. Chicago. American Medical Association, 1985.

Anderson, H.: Outpatient care fuels Catholic systems. *Modern Healthcare* 15(24):26-27, Nov. 1985.

Barkholz, D.: Aggressive marketing slows decline in hospital admissions, patient days. *Modern Healthcare* 15(23):40, Nov. 1985.

Board of Trustees, Federal Hospital Insurance Trust Fund: *1985 Annual Report of the Board of Trustees of the Federal Hospital Insurance Trust Fund*. House Document 99-46. Washington. U.S. Government Printing Office, Apr. 1985.

Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Trust Fund: *1985 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Trust Fund*. House Document 99-47. Washington. U.S. Government Printing Office, Apr. 1985.

Board of Trustees, Federal Supplementary Medical Insurance Trust Fund: *1985 Annual Report of the Board of Trustees of the Federal Supplementary Medical Insurance Trust Fund*. House Document 99-48. Washington. U.S. Government Printing Office, Apr. 1985.

Bureau of Health Professions, Health Resources and Services Administration. Unpublished projections, 1985.

Bureau of Labor Statistics. *Employee Benefits in Medium and Large Firms, 1984*. Bulletin 2237. Washington. U.S. Government Printing Office, June 1985.

Business Week. The race for miracle drugs. 2904:92-96, July 22, 1985.

Cassak, D.: Partners in healthcare—merging the financing and delivery of care. *Health Industry Today* 48(10):38-43, Oct. 1985.

Coddington, D., Palmquist, L., and Trollinger, W.: Strategies for survival in the hospital industry. *Harvard Business Review*: 63(3):129-138, May-June 1985.

Davis, K., Anderson, G., Renn, S., Rowland, D., Schramm, C., and Steinberg, E.: Is cost containment working? *Health Affairs* 4(3):81-94, Fall 1985.

Economic Report of the President: Washington. U.S. Government Printing Office, Feb. 1985.

Fisher, C.: Differences by age groups in health care spending. *Health Care Financing Review*. Vol. 1, No. 4. HCFA Pub. No. 03045. Office of Research, Demonstrations, and Statistics, Health Care Financing Administration. Washington. U.S. Government Printing Office, Spring 1980.

Goldsmith, J.: Death of a paradigm: The challenge of competition. *Health Affairs* 3(3), Fall 1984.

Jensen, J., and Miklovic, N.: Eighty-three percent of hospitals reporting increased outpatient use. *Modern Healthcare* 15(22):86-88, Oct. 1985.

Levit, K., Lazenby, H., Waldo, D., and Davidoff, L.: National health expenditures, 1984. *Health Care Financing Review*. Vol. 7, No. 1. HCFA Pub. No. 03206. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U. S. Government Printing Office, Nov. 1985.

National Center for Health Statistics, Division of Health Interview Statistics: Data from the National Health Interview Survey, 1981.

National Center for Health Statistics, Division of Health Care Statistics: Data from the National Hospital Discharge Survey, 1981.

National Center for Health Statistics, Division of Health Care Statistics: Data from the National Nursing Home Survey, 1977.

National Center for Health Statistics and National Center for Health Services Research: Data from the National Medical Care and Expenditure Survey, 1977.

National Center for Health Statistics and Health Care Financing Administration: Data from the National Medical Care Utilization and Expenditure Survey, 1980.

Punch, L.: Healthcare construction boom continued to show vigor in 1984. *Modern Healthcare* 15(5):63-88, Mar. 1985.

Russell, L.: An aging population and the use of medical care. *Med Care* 49(6):633-643, June 1981.

Wade, A.: Social security area population projections, 1985. Actuarial Study No. 95. SSA Pub. No. 11-11542. Office of the Actuary, Social Security Administration. Washington. U.S. Government Printing Office, Oct. 1985.

Waldo, D., and Lazenby, H.: Demographic characteristics and health care use and expenditures by the aged in the United States: 1977-1984. *Health Care Financing Review*. Vol. 6, No. 1. HCFA Pub. No. 03176. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Fall 1984.

Comparison of alternative relative weights for diagnosis-related groups

by Philip Cotterill, Joel Bobula, and Rose Connerton

During this study, we investigated the extent to which diagnosis-related group (DRG) relative weights based exclusively on charge data differ from DRG weights constructed according to the methodology used in deriving the original relative weights for the Medicare prospective payment system (PPS). The PPS operating cost weights were based on a combination of cost and adjusted charge information (Pettengill and Vertrees, 1982).

The results of this study reveal only minor differences between the two sets of weights. Interhospital differences in cost-to-charge ratios do not produce large, arbitrary differences between charge-based and operating cost weights. Whether the data are standardized for differences in capital and medical education costs also appears to make little difference.

Introduction

On October 1, 1983, the Health Care Financing Administration (HCFA) began the implementation of a new system for making Medicare payments to hospitals for inpatient services. The new system changed the method of payment for inpatient hospital services from a cost-based retrospective reimbursement system to a diagnosis-specific prospective payment system. Implementation of the new prospective payment system was preceded by nearly a decade of research and demonstrations by HCFA in order to develop the necessary elements required for such a system.

The first step in the research and development process was the development of a system that classified hospital cases into a manageable number of categories such that the cases within each category are clinically coherent and reasonably homogeneous in cost. After evaluating a number of different patient classification systems, HCFA selected a system called diagnosis-related groups (DRG's) that was developed at Yale University. In the DRG system, patients are grouped into 467 categories derived from a multistage process of clinical judgment and statistical analysis. The DRG system is designed for use with diagnosis and procedure information coded in the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) coding system. Under the prospective payment system (PPS), each Medicare discharge is classified into one of these mutually exclusive and comprehensive categories.

The second step in the process was the development of a set of relative weights that measure the relative costliness of each of the DRG case categories. Relative weights based on the average cost per case in each DRG, rather than the average charge per case, were chosen on the assumption that average cost weights better reflect relative resource use across case categories. The relative weights were developed using a sample of Medicare bills and Medicare Cost Reports from approximately 5,500 hospitals. The process of constructing relative cost weights involved classifying a sample of approximately 20 percent of all 1981 Medicare discharges into DRG's, computing an estimated cost for each discharge, standardizing the cost data to account for variations in input factor prices and variations in the level of hospitals' teaching activity, computing an average cost per DRG, and finally, deriving a measure of the relative costliness of each DRG called the relative cost weight.

The final step was the development of a hospital case-mix index (CMI) using the DRG classification scheme and cost weights developed in the first two steps. The CMI is a ratio that compares each hospital's expected average cost for the types of Medicare cases it treats to the national average cost per Medicare case. A critical test of the usefulness of the CMI (and its component parts) was the determination of the extent to which hospital CMI values are related to hospital average cost per case values. Various statistical tests supported the hypotheses that the resultant CMI is a significant factor explaining variation in average Medicare cost per case among the hospitals and that the CMI is proportionately related to Medicare cost per case. These findings provided strong indirect evidence that the CMI is a valid representation of the expected costliness of an individual hospital's Medicare patient mix (Pettengill and Vertrees, 1982). The results of each of these steps in the research and development process led HCFA to conclude that a prospective payment system for hospital inpatient services could be implemented using available Medicare data.

Relative weights based on average costs

The original relative weights used in the Medicare prospective payment system (PPS) were based on standardized cost data for a sample of 1981 Medicare discharges. Average costs, rather than average charges, were used on the assumption that average cost weights better reflect relative resource use across case categories. In a fully competitive market, total charges (prices) for different case types would be equal to the minimum average costs of production and, from the perspective of economic efficiency,

Reprint requests: Philip Cotterill, 2-B-14 Oak Meadows Building, 6325 Security Boulevard, Baltimore, Maryland 21207.

would provide suitable weights for the case categories. However, the market for hospital inpatient services was considered to depart sufficiently from the competitive norm to cast doubt on the use of charge data alone in the weight construction process (Pettengill and Vertrees, 1982). Given that most inpatient hospital services are covered by health insurance and that the hospital industry is dominated by nonprofit providers, markets for hospital inpatient treatment cannot be characterized as strongly price competitive. Further, past hospital reimbursement methods were thought to have encouraged hospitals to set prices to cross-subsidize between routine and ancillary services and among ancillary services.

As a result, average hospital charges for each case category were not considered to reflect efficient costs of production. Instead, an alternative approach was adopted that used a combination of charge and cost information. Routine costs, special care costs, and ancillary charges reported by hospitals for each case in a DRG category were adjusted, based on data from the Medicare Cost Reports and other data files, to account for the gross effects of hospital pricing policies, variations in factor input prices, and variations in the level of teaching activity. Though subject to their own limitations, the resultant set of cost weights were considered to better represent the efficient relative cost of treatment for a given DRG category than would relative weights based on unadjusted charges.

Purpose of this study

The purpose of this study was to investigate the extent to which DRG weights based on costs differ from DRG weights constructed exclusively from charge data, and to investigate the source(s) of any differences. Charge data have some potential advantages compared with operating cost data for constructing DRG relative weights. Weights based on charges would be more timely, because they would not require cost report data that is typically 2 to 3 years old before it becomes available for analytical purposes. Charge-based relative weights would also be simpler to construct, because a series of adjustments would not be required to convert charges to costs.

However, charge-based weights might be less reflective of true resource costs than cost weights are. Pettengill and Vertrees (1982) give two reasons for choosing cost data instead of charge data for the construction of DRG relative weights:

- Significant differences in cost-to-charge ratios among hospitals may result in large arbitrary differences between charge-based and cost-based weights.
- Charge-based weights that are not standardized for differences among hospitals in capital and medical education costs may differ significantly from operating cost weights.

The chief reason for including the cost-to-charge adjustment in computing relative weights is to compensate for possible distortions between costs and charges that are the result of the variety of pricing policies used by hospitals. For example, cross-subsidization by hospitals in their pricing of routine and ancillary services might be expected to make charge-based weights more compressed than the current set of operating cost weights. If relatively inexpensive, highly utilized services are priced to subsidize expensive, less frequently utilized services, charges for high (low) weight DRG's may underestimate (overestimate) true resource costs relative to the operating cost weights.

To assess the relative advantages and disadvantages of using charge data, we computed a set of charge-based relative weights and compared them with a comparable set of weights based on operating costs. Our analysis will not permit us to determine whether either set of relative weights is a good measure of the resources used to treat hospital inpatients; however, it will permit the evaluation of the differences between the two measures. We also investigated the sources of observed differences and estimated the relative importance of each source. Finally, we tested the hypotheses that a CMI developed from charge-based relative weights is a significant factor that explains the variation in average Medicare cost per case and that it is proportionately related to Medicare cost per case.

The following are provided in this article:

- Background information on the development of the original set of relative cost weights used in the Medicare prospective payment system.
- Data sources and methodology used in the construction of the charge-based relative weights and the major sources of differences between the methodologies used to construct the operating cost and charge-based relative weights.
- A comparison of the alternative sets of relative weights.
- A detailed analysis of the source(s) of any differences between the sets of weights.
- An assessment of the relationship between case-mix index values constructed from charge-based relative weights and hospital average cost per case values.
- A summary of the findings of this study.

Cost-based relative weights

The diagnosis-related group (DRG) weights used in the prospective payment system (PPS) were calculated by a complex methodology using data from the 1981 Medicare provider analysis and review (MEDPAR) file, the 1981 Medicare Cost Report abstract file, and the 1981 hospital wage index based on hospital wage information collected by the Bureau of Labor Statistics (BLS) of the U.S. Department of Labor. The MEDPAR file contains Medicare stays for a 20-percent sample of Medicare beneficiaries discharged from short-stay hospitals. It also contains detailed charge data for each bill (including the number of days and charges for routine care and special care); separate charges for seven categories of ancillary services (pharmacy, radiology, laboratory, medical supplies, operating room, anesthesiology, and

other ancillaries; a limited amount of clinical information, such as principal diagnosis and principal procedure; and selected demographic characteristics, such as age and sex.[1]

The Medicare Cost Report abstract file contains detailed cost report information for hospitals providing inpatient care to Medicare beneficiaries. The cost reports provide the basis for settling the amount of final Medicare payment in a given fiscal year. The cost reports contain information on operating costs, capital costs, medical education costs, and on aggregate cost-to-charge ratios for a number of different revenue centers. The 1981 Medicare Cost Report abstract file was supplemented with additional information, such as the number of Medicare discharges for each hospital in 1981, from other statistical files maintained in the central office of the Health Care Financing Administration (HCFA).

The 1981 hospital wage index used in the computation of relative weights was a county-level hospital wage index developed for HCFA by the BLS. The BLS constructed the hospital wage index by using compensation and employment data for hospital workers based on quarterly tax reports submitted by hospitals to State employment security agencies. The BLS file is used to adjust the cost and charge data for variations in area wages across hospitals.[2]

Constructing cost-based relative weights

The DRG relative weights are estimates of the relative resource intensity of each DRG. These weights are computed by estimating the average resource intensity per case for each DRG, measured in dollars, and dividing each of those values by the average resource intensity per case for all DRG's, also measured in dollars. The result is a set of relative weights, one for each DRG.

Computation of the DRG weights entailed several discrete steps. First, all cases from the 1981 MEDPAR file were assigned to a DRG classification category. Second, an estimate of the cost for each case was computed. This was accomplished by adding together for each case the following three components:

- The number of days the patient spent in a regular room (from MEDPAR) times the hospital's routine cost per day (from the Medicare Cost Report).
- The number of days the patient spent in a special care unit (from MEDPAR) times the hospital's special care cost per day (from the Medicare Cost Report).
- Ancillary charges for seven ancillary departments (from MEDPAR) times the relevant departmental cost-to-charge ratio (from the Medicare Cost Report).

This procedure was applied to approximately 2 millon records from hospitals for which adequate cost report data were available. Direct medical education costs and capital costs were removed from the estimated cost per case by using data from the Medicare Cost Report file. Direct medical education and capital costs were removed because, at least initially, they continue to be reimbursed on a retrospective basis under PPS. Costs in excess of the routine cost limits applicable in 1981 were also removed.

Third, the estimated cost per case was adjusted for estimated indirect teaching costs in order to standardize for variations in the level of teaching activity across hospitals. This is accomplished by dividing the estimated cost for each case in a given hospital by a teaching adjustment factor computed for that hospital. The teaching adjustment factor was developed from a multivariate analysis of hospital costs that indicated that teaching hospitals' expected costs per case differ by slightly less than 6 percent for each 10-percent difference in their resident-to-bed ratios (Pettengill and Vertrees, 1982). Hence, a teaching hospital with a resident-to-bed ratio of 0.2 would have its estimated costs per case reduced by a factor of approximately 12 percent.

Fourth, estimated costs per case were standardized for differences in area wages across hospitals. This is accomplished by deflating the labor share of the estimated cost of each case by the appropriate wage index value from the BLS hospital wage index. The labor share of the average Medicare case was estimated by HCFA's Office of Financial and Actuarial Analysis to be 0.7915. The nonlabor share, estimated to be 0.2085, was not adjusted (except for Alaska and Hawaii) because HCFA had no reliable measure of variations in prices of nonlabor inputs across hospitals.

Fifth, extreme values were excluded from each DRG category. Criteria for excluding statistical outlier cases were set at plus or minus three standard deviations of the geometric mean cost per case for each DRG. The geometric mean was used instead of the arithmetic mean because the distribution of cases within each DRG is skewed to the right. (Cost per case values can be extremely large, but cannot be less than zero.) Use of the geometric mean better enables the identification of unusually low and unusually high costs per case. Roughly 10,000 out of approximately 2 million cases (one-half of 1 percent) were excluded on the basis of these criteria.

The final step was the computation of the relative weights. This was accomplished by dividing the case-weighted, arithmetic mean cost per case for each DRG by the average cost per case for all DRG's, where the

[1]In contrast to the 1981 data, the 1984 data contain discharge information for 100 percent of all Medicare beneficiaries. In addition to the diagnosis, length of stay, and charge information contained in the 1981 data, the 1984 data contain additional diagnostic information on up to three surgical procedures and four secondary diagnoses.

[2]For a detailed discussion of the contents of these data sources and of problems of data quality, see Pettengill and Vertrees (1982) or Lave (1985).

average cost per case for all DRG's is defined as follows:

$$1/M \sum_{j=1}^{M} 1/N_j \sum_{i=1}^{n} N_{ij} C_i ,$$

where

M = number of hospitals
N_j = total number of cases in hospital j
N_{ij} = number of cases in DRG i and hospital j
C_i = arithmetic mean adjusted cost per case for DRG i.
n = number of DRG's.

This definition of the average cost per case for all DRG's is a hospital weighted mean of the case weighted mean of the adjusted cost per case for all DRG's. Weighting by hospital allows each hospital, regardless of its Medicare patient load, to exert an equal effect on the calculation of the average cost per case.

Evaluating cost-based relative weights

Prior to implementation of the PPS, an attempt was made to assess the validity of the resultant set of cost-based relative weights (Pettengill and Vertrees, 1982). A direct assessment was not possible, because no other independent measure of the relative structure of costs across DRG's was available. However, an indirect assessment was attempted by evaluating the relationship between hospital CMI values constructed from the cost-based relative weights and hospital average cost per case values. Finding that CMI values based on the relative weights are proportionately related to average cost per case values (e.g., a hospital with a 10-percent higher CMI value has a 10-percent higher average cost per case) would provide strong indirect evidence of the validity of the CMI and its component parts, the cost-based relative weights.

The relationship between hospital CMI values and hospital operating cost per case values was tested by estimating a single-equation, average cost function using 1981 Medicare Cost Report data from approximately 5,000 hospitals. The cost function assumed Medicare cost per case to be a function of case mix, teaching intensity, hospital wages in the local area, bed size, and size of standard metropolitan statistical area. Ordinary least-squares regression was used to estimate the coefficients of the independent variables.[3] The regression equation explained 72 percent of the variation in Medicare cost per case. More importantly, CMI values were found to be approximately proportional to operating cost per case values, as expected.

Additional sensitivity analyses were conducted to assess the stability of the estimated regression equation in response to potential classification errors, specification errors, and errors in the measurement of the dependent and independent variables. The results of these analyses led HCFA to conclude that the Medicare CMI constructed from cost-based relative weights provides a generally accurate representation of the expected costliness of an individual hospital's patient mix.

There are, however, some problems associated with the method used to construct the cost-based relative weights used in PPS. First, there is a 2-year or 3-year lag between the date of the Medicare Cost Report data and the date when the file becomes available for analysis. Second, the process of constructing cost-based weights is relatively data intensive. The original set of cost-based relative weights required data from five different Medicare files. In addition, a series of adjustments were required in deriving standardized operating costs. Pass-through costs, such as direct medical education and capital costs, were identified and removed from cost report data for each hospital. Also, charges were converted to costs for seven different ancillary departments from each hospital. Finally, costs were adjusted to account for differences in wage levels and indirect medical education costs across hospitals.

Having made all of these adjustments, the resulting set of relative weights may be compressed to some unknown extent. That is, the weights probably underestimate the cost of the high-weight DRG's and overestimate the cost of the low-weight DRG's. For routine and special care costs, compression results from the use of the average cost per day for all cases within a given hospital, irrespective of the DRG category. Thus, the operating cost weights do not reflect intra-DRG variations in the intensity of nursing and other routine and special care services among patients in different DRG's. The effect of this omission may bias the low-cost DRG categories upward and the high-cost categories downward.

Also, within each ancillary category, average cost-to-charge ratios are used for all cases within a given hospital, again irrespective of the DRG category. If within ancillary categories charges are set so that the less expensive services subsidize the more expensive services, then the cost of cases with above-average ancillary costs may be underestimated, and the costs of cases with below-average ancillary costs may be overestimated. Adjustments using departmental cost-to-charge ratios can only compensate for cross-subsidization that occurs across, not within, cost categories. Again, the effect may be to bias the low-cost DRG categories upward and the high-cost DRG categories downward.

Charge-based relative weights

As noted earlier, charge-based weights have some potential advantages over operating cost weights. Weights based on charges could be constructed without cost report data that are typically 2 to 3 years old before they become available for analysis. Charge-based relative weights are also simpler to compute,

[3]The cost function was specified as linear in logarithms. That is, the values of the dependent and independent variables (except city size) were transformed into logarithms before the cost function was estimated.

because adjustments are not required to convert charges to costs and to remove capital and medical education costs. However, it is possible that charge-based relative weights might be even less reflective of true resource costs than the operating costs weights are. Specifically, the omission of the cost-to-charge and pass-through cost adjustments could result in charge-based relative weights that differ markedly from cost-based relative weights. Also, cross-subsidization in the pricing of high-cost and low-cost services could make charge weights even more compressed than operating cost weights. (The compression of routine and special care costs noted earlier is very likely also to apply to charges for these services so that both the operating cost and the charge weights can be expected to suffer from this source of compression.)

To investigate these concerns, a set of charge-based relative weights (with no adjustment for cost-to-charge ratios and pass-through costs) were computed and compared with a comparable set of weights based on operating costs. The charge weights were constructed from calendar year 1981 Medicare provider analysis and review (MEDPAR) data, the same data set that was used in conjunction with the Medicare Cost Report abstracts to construct the original operating cost weights for the prospective payment system (PPS).

Constructing charge-based relative weights

A guiding principle in deriving the charge-based set of weights used in this analysis was that the methodology be as similar as possible to that used in deriving the original set of PPS relative weights. However, it was sometimes necessary to modify the procedures used in deriving the PPS relative weights. For example, the charge weights used in this analysis were restricted to the 358 diagnosis-related groups (DRG's) for which the 1981 MEDPAR contains a sufficient number of cases to yield reliable weights. For 109 low-volume DRG's, the 1981 MEDPAR file had to be supplemented with outside data from Maryland and Michigan, data that was not used in this analysis. For purposes of consistency, the cost weights used in this analysis were also restricted to the same 358 DRG's.

The cost weights computed for this analysis differ only slightly from the PPS relative weights published in the *Federal Register* (1983). The Pearson correlation coefficient between the cost weights computed for this analysis and the published weights is very high, .99. The small differences that do exist can be attributed to the following factors. First, the operating cost weights used in this analysis were computed for the 358 DRG's for which MEDPAR contained a sufficient number of cases, whereas the published weights incorporate data from Maryland and Michigan for 109 low-volume DRG's. Hence, values for the 358 common DRG's may differ because a different denominator is used in computing the relative weights in the two cases. Second, kidney acquisition costs were removed in computing the published weights, but were not removed in computing the cost weights for this study, because these costs were not on the files available for this analysis. Third, the operating cost weights were standardized by using slightly different wage indexes and indirect teaching factors than the published weights were. For the operating cost weights, we used the June 30, 1981, BLS wage index and a .05795 indirect teaching factor that was based on 1981 data, both of which are used for PPS payments. However, the published relative weights are based on the March 18, 1981, BLS wage index and a .06063 indirect teaching factor that was based on 1980 data. The main difference between the two wage indexes concerns the classification of certain metropolitan statistical areas as rural or urban, rather than the wage data themselves.

The chief differences between the cost weights and the charge weights developed in this study are as follows:

- Per diem costs (from the Medicare Cost Reports) were used in conjunction with length-of-stay information from the MEDPAR file in computing the routine and special care components of the operating cost weights, whereas routine and special-care charges (from the MEDPAR file) were used in computing the charge-based relative weights.
- Ancillary charges (from the MEDPAR file) were adjusted by the relevant ancillary department cost-to-charge ratio (from the Medicare Cost Report) in computing the ancillary component of the operating cost weights, whereas unadjusted ancillary charges were used in computing the charge-based relative weights.
- Pass-through costs have been removed from the operating cost weights, but not from the charge weights.

For the cost weights, capital and direct medical education costs were removed from routine, special care, and ancillary costs in exactly the same manner used in deriving the original PPS weights. The method is equivalent to estimating these costs as proportions of routine costs, special care costs, and ancillary costs and using those proportions to reduce the respective cost elements. The cost weights were also standardized for differences in indirect medical education costs, whereas the charge weights were not standardized.

The same standardization for wage differences was applied to both sets of weights. This standardization is the same as that used in developing the published weights except for the difference in wage indexes described earlier. The labor-related share was assumed to be .7915 of both costs and charges This assumption was used because more accurate shares for charges are not available.

The same criterion used in computing the published weights was used to eliminate statistical outliers for both sets of weights. All cases outside of three standard deviations from the mean of the log distribution of costs or charges per case for each DRG

Table 1

Method of computation of estimated cost per case and of adjustments to estimated costs per case

Type of cost and adjustment	Cost weights			Charge weights
		Method of computation		
Total cost	Routine + special care + ancillaries			Routine + special care + ancillaries
Routine cost	Hospital-specific routine per diem cost (Cost report)	X	Case-specific routine length of stay (MEDPAR)	Routine accommodations charges (MEDPAR)
Special care cost	Hospital-specific special care per diem cost (Cost report)	X	Case-specific special care length of stay (MEDPAR)	Special care charges (MEDPAR)
Ancillary cost	Hospital-specific cost to charge ratios for 7 categories of ancillary services (Cost report)	X	Case-specific charges for 7 categories of ancillary services (MEDPAR)	Ancillary department charges (MEDPAR)
		Method of adjustment		
Pass-through adjustment	Capital and direct medical education costs were removed from routine, special care, and ancillary costs based on hospital specific estimates of the ratios of routine, special care, and ancillary capital and medical education costs to total, routine, special care and ancillary costs.			No adjustment
Indirect teaching adjustment	Indirect medical education costs were removed based on a hospital specific estimate of the teaching adjustment factor (1 + (.5795 × Residents/Beds)).			No adjustment
Wage adjustment	Area wage differences were removed based on an area-specific 1981 Bureau of Labor Statistics wage index applied to the labor share of the estimated cost per case.			Same adjustment

were eliminated from the calculation of the relative weights.

Once the arithmetic mean costs or charges per case were determined for each DRG, they were converted to relative weights by using the same definition for the mean costs or charges for all DRG's that was used in computing the PPS relative weights. The definition used is the hospital weighted mean of the case weighted mean of the standardized costs (charges) per case for all DRG's.

A summary of the major differences between the methodologies used in constructing both sets of weights is presented in Table 1. A comparison of the resultant sets of operating cost weights and charge-based weights will permit isolation of the impact of not adjusting for cost-to-charge ratios and pass-through costs in the construction of charge-based relative weights. However, it should be noted that the analysis will not permit determination of whether either set of relative weights is a good measure of the true resource costs of treating hospital inpatients. It will, however, permit an evaluation of the differences between the two measures and of the sources of any such differences.

Comparison of alternative relative weights

A comparison of the 1981 operating cost weights and the 1981 total charge weights is presented in this section. The results of the analysis indicate that relative weights based on 1981 MEDPAR data are largely invariant, regardless of the methodology used. A summary of the major findings is presented below.

First, the relative weights computed by each method are quite similar. As indicated in Table 2, the difference between relative weights based on operating costs and relative weights based on total charges is less than 5 percent for most of the DRG's.

Second, the structure of the relative weights across DRG's for each method are also very similar. The

Table 2

Number of diagnosis-related groups and number and percent distribution of cases, by percent by which charge weights differ from cost weights

Percent by which charge weights differ from cost weights	Number of DRG's	Number of cases	Percent distribution of cases
Total	358	1,845,267	100.0
15-20 percent less	0	0	0.0
10-15 percent less	0	0	0.0
5-10 percent less	12	98,232	5.3
0-5 percent less	136	976,883	52.9
0-5 percent more	160	674,720	36.6
5-10 percent more	41	84,993	4.6
10-15 percent more	8	9,960	0.5
15-20 percent more	1	479	0.0

NOTES: DRG's are diagnosis-related groups. MEDPAR is Medicare provider analysis and review. Data are based on the 358 DRG's for which sufficient information was available on the 1981 MEDPAR file to compute relative weights.

Spearman correlation coefficient, which measures the correspondence of the rank ordering of pairs of observations, and the Pearson correlation coefficient, which measures the correspondence of actual values between two sets of observations, are both greater than .99. A comparison of cost and charge weights for the top 25 DRG's in terms of frequency is presented in Table 3.

Third, the relative dispersion of costs or charges within a DRG are very similar for each method. When charge data are used, coefficients of variation for each DRG (the ratio of the standard deviation to the mean) are slightly higher than they would be if cost data were used. However, in general, the difference is less than 5 percent, with only a few coefficients of variation differing by as much as 10 percent. In some cases, the coefficients of variation are even lower when charge data are used. A comparison of coefficients of variation for the top 25 DRG's in terms of frequency is presented in Table 4.

Fourth, the dispersion of average costs or charges across DRG's are also very similar, as indicated in Table 5. The standard deviation of the charge-based weights is slightly larger than the standard deviation of the cost-based weights, which means that the charge-based relative weights are slightly less compressed than the cost-based relative weights. DRG's with high (low) relative weights are likely to be slightly higher (lower) if computed using charge data rather than cost data.

Finally, as indicated in Tables 6 and 7, hospital case-mix index values computed on the basis of charge-based weights are very similar to case-mix index values computed on the basis of cost weights. In Table 6 we observe, however, that large urban hospitals have higher case-mix index values using charge-based weights rather than cost-based weights. Small rural hospitals, on the other hand, have lower case-mix index values using charge-based weights. This finding is a consequence of the earlier finding that charge-based weights are slightly less compressed than the cost-based weights. Similarly, teaching hospitals have higher case-mix index values using charge-based weights rather than cost-based weights.

Table 3

Total number of cases, total charge weights, operating cost weights, and percent difference between the two weights for the top 25 diagnosis-related groups: 1981

Code number	Diagnosis-related group	Total number of cases[1]	Total 1981 charge weights[2]	1981 operating cost weights[2]	Percent difference
127	Heart failure and shock	76,628	1.0375	1.0400	−0.24
182	Esophagitis, gastroenteritis, and miscellaneous digestive diseases	73,963	.5951	.6174	−3.61
132	Atherosclerosis, age > 69 and/or C.C.	70,442	.8857	.9167	−3.38
39	Lens procedure	66,340	.5058	.5005	1.06
88	Chronic obstructive pulmonary disease	52,500	1.0829	1.0432	3.81
14	Specific cerebrovascular disorders, except transient ischemic attacks	51,869	1.3400	1.3508	−0.80
89	Simple pneumonia, age > 69 and/or C.C.	46,376	1.1270	1.1028	2.19
468	Unrelated OR procedure	44,282	2.1874	2.1034	3.99
122	Circulatory disorders with AMI (121 and 122 combined)	39,947	1.4141	1.5007	−5.77
294	Diabetes, age > 36	39,284	.7842	.8072	−2.85
140	Angina pectoris	36,711	.7356	.7545	−2.50
243	Medical back problems	36,328	.7240	.7554	−4.16
138	Cardiac arrhythmia and conduction disorders	29,228	.9163	.9295	−1.42
134	Hypertension	27,165	.6837	.7045	−2.95
15	Transient ischemic attacks	26,306	.6624	.6674	−0.75
96	Bronchitis and asthma, age > 69 and/or C.C.	26,214	.8077	.7994	1.04
467	Other factors influencing health status	25,158	.9637	.9795	−1.61
82	Respiratory neoplasms	24,586	1.1802	1.1413	3.41
320	Kidney and urinary tract infections	22,167	.8087	.8108	−0.26
130	Peripheral vascular disorders	21,569	.9453	.9635	−1.89
296	Nutritional and miscellaneous metabolic diseases	20,547	.9015	.8970	0.50
183	Esophagitis, gastroenteritis and miscellaneous digestive diseases	19,814	.5539	.5652	−2.00
174	G.I. hemorrhage, age > 69 and/or C.C.	19,134	.9405	.9282	1.33
395	Red blood cell disorders, age > 17	18,742	.7961	.7842	1.52
336	Transurethral prostatectomy	18,215	1.0049	1.0075	−0.26

[1]Total number of cases including statistical outliers. Statistical outlier cases were excluded from the computation of the relative weights reported in columns two and three.

[2]Based on the 358 DRG's for which sufficient information was available on the 1981 file to compute relative weights.

NOTES: C.C. is complication and/or comorbidity; OR is operating room; AMI is acute myocardial infarction; and G.I. is gastrointestinal. The 25 DRG's listed above accounted for 47.8 percent of total MEDPAR cases in 1981.

Table 4

Coefficients of variation for total charge weights and total operating cost weights for the top 25 diagnosis-related groups in terms of frequency: 1981

Code number	Diagnosis-related group	Total 1981 charge weights[1]	1981 operating cost weights[1]
127	Heart failure and shock	.9208	.8912
182	Esophagitis, gastroenteritis and miscellaneous digestive diseases	.8414	.8049
132	Atherosclerosis, age > 69 and/or C.C.	.8930	.8832
39	Lens procedure	.3752	.3576
88	Chronic obstructive pulmonary disease	.9821	.9390
14	Specific cerebrovascular disorders, except transient ischemic attacks	1.0428	1.0074
89	Simple pneumonia, age > 69 and/or C.C.	.9298	.8777
468	Unrelated OR procedure	1.1278	1.0714
122	Circulatory disorders with AMI (121 and 122 combined)	.6966	.6889
294	Diabetes, age > 36	.8566	.8167
140	Angina pectoris	.7199	.7262
243	Medical back problems	.7547	.7267
138	Cardiac arrhythmia and conduction disorders	.9495	.9392
134	Hypertension	.8868	.8600
15	Transient ischemic attacks	.8409	.8171
96	Bronchitis and asthma, age > 69 and/or C.C.	.8093	.7601
467	Other factors influencing health status	1.1511	1.0902
82	Respiratory neoplasms	1.0842	1.0534
320	Kidney and urinary tract infections	.8432	.7946
130	Peripheral vascular disorders	1.0576	1.0119
296	Nutritional and miscellaneous metabolic diseases	.9988	.9454
183	Esophagitis, gastroenteritis and miscellaneous digestive diseases	.8261	.8027
174	G.I. Hemorrhage, age > 69 and/or C.C.	.9115	.8780
395	Red blood cell disorders, age > 17	.8954	.8641
336	Transurethral prostatectomy	.5513	.5290

[1] Based on the 358 DRG's for which sufficient information was available on the 1981 Medicare provider analysis review to compute relative weights.

NOTES: C.C. is complication and/or comorbidity; OR is operating room; AMI is acute myocardial infarction; and G.I. is gastrointestinal. The 25 DRG's listed above accounted for 47.8 percent of total MEDPAR cases in 1981.

Table 5

Number of diagnosis-related groups, mean relative weight, and associated standard deviation for each method of computing relative weights, by type of weight

Type of weight	Number of DRG's[1]	Mean relative weight	Standard deviation
Operating cost weight	358	1.2186	0.8022
Total charge weight	358	1.2486	0.8745

[1] DRG = diagnosis-related group.

NOTES: Data are based on the 358 DRG's for which sufficient information was available on the 1981 Medicare provider analysis review file to compute relative weights. The means reported above are DRG weighted. Relatively low frequency, high-weight DRG's have a greater impact on the DRG weighted mean than on the hospital weighted mean of the case weighted DRG means used in the prospective payment system. As a result, the means reported above are greater than 1.

Nonteaching hospitals, on the other hand, have lower case-mix index values using charge-based weights. The distribution of hospitals by percent difference between charge-based and cost-based case-mix index values is given in Table 7. Only 94 out of a total of 5,501 hospitals would have observed more than a 3-percent difference in their case-mix index value had charges rather than costs been used in constructing case-mix indexes. No hospitals would have observed more than a 6-percent difference in their case-mix index values.

Table 6

Case-mix index values for operating cost weights and total charge weights, by type of hospital, bed size, and hospital teaching status

Type of hospital, bed size, and teaching status	Operating cost weights	Total charge weights
	Case-mix index values	
Urban hospital		
Group 1 (0-99 beds)	.9686	.9657
Group 2 (100-404 beds)	1.0486	1.0526
Group 3 (405-684 beds)	1.1094	1.1208
Group 4 (685 beds or more)	1.1447	1.1623
Rural hospital		
Group 5 (0-99 beds)	.9444	.9391
Group 6 (100-169 beds)	.9877	.9863
Group 7 (170 beds or more)	1.0258	1.0278
Teaching status		
Nonteaching hospitals	.9827	.9808
Teaching hospitals with residents to bed ratio under .25	1.0802	1.0879
Teaching hospitals with residents to bed ratio over .25	1.1410	1.1598

NOTE: Data are based on the 358 DRG's for which sufficient information was available on the 1981 Medicare provider analysis review file to compute relative weights.

Table 7

Number and percent distribution of hospitals, by percent by which charge-based case-mix indexes differ from cost-based case-mix indexes

Percent by which charge-based case-mix indexes differ from cost-based case-mix indexes	Number of hospitals	Percent distribution of hospitals
Total	5,501	100.0
5-6 percent less	0	0.0
4-5 percent less	0	0.0
3-4 percent less	24	0.5
2-3 percent less	38	0.7
1-2 percent less	531	9.7
0-1 percent less	2,290	41.6
0-1 percent more	2,161	39.3
1-2 percent more	340	6.2
2-3 percent more	85	1.5
3-4 percent more	24	0.4
4-5 percent more	6	0.1
5-6 percent more	2	0.0

NOTE: Data are based on the 358 DRG's for which sufficient information was available on the 1981 Medicare provider analysis review file to compute relative weights.

Interpretation of the results

Three adjustments made in constructing the operating cost weights were omitted in constructing the charge weights (the charge-to-cost adjustment and the standardizations for differences in capital and medical education costs). The similarity of the charge and the operating cost weights indicates that these adjustments have little effect on the structure of the relative weights. The chief difference between the two sets of weights is that the charge weights are less compressed than the operating cost weights. That is, the charge weights tend to be greater (less) than the operating cost weights for DRG's with relatively high (low) operating cost weights. In this section, we attempt to provide explanations for these results. In particular, we attempt to answer the following two questions:

- Why do interhospital differences in cost-to-charge ratios and pass-through costs produce relatively small differences between charge-based and operating cost weights?
- Why are the charge-based weights less compressed than the operating cost weights?

Similarity of alternative relative weights

If the charge-based and operating cost weights were identical, then the ratio of the charge-based to the operating cost weight would be equal to one for every DRG. Since the two sets of weights are very similar, the ratio does not vary greatly from one. As shown in Table 2, no DRG had a charge-based weight that was more than 10 percent less than the operating cost weight. In addition, no DRG had a charge-based weight that was more than 20 percent greater than the operating cost weight. These results imply that the ratio of the charge-based weight to the operating cost weight ranges from a low of approximately .90 to a high of approximately 1.20.

We examined why the charge-based and operating cost weights are so similar by investigating the relative constancy across DRG's of the ratio of total charges per case to operating cost per case. Comparing the charges-to-operating cost ratio is essentially equivalent to comparing the ratio of the two relative weights. These alternative comparisons yield equivalent results because the relative weights are constructed by dividing the mean operating cost or charges for each DRG by the mean operating cost or charges for all DRG's. Hence, for each DRG, the ratio of the charge-based to the operating cost weight is equal to the ratio of the mean charges per case to the mean operating cost per case multiplied by the ratio of the mean operating cost to the mean charges for all DRG's as shown below:

$$\frac{\text{Charge weight}_i}{\text{Cost weight}_i} = \frac{\text{Mean charge}_i/\text{Mean charge all DRG's}}{\text{Mean cost}_i/\text{Mean cost all DRG's}}$$

$$= \frac{\text{Mean charge}_i}{\text{Mean cost}_i} \times \frac{\text{Mean cost all DRG's,}}{\text{Mean charge all DRG's}}$$

The ratio of the mean cost for all DRG's to the mean charge for all DRG's is the same for each DRG. Therefore, variation across DRG's in the ratio of the two sets of relative weights is fully reflected in the ratio of the mean charges per case to the mean operating cost per case.

A hypothetical example is useful to show how the operating cost and charge-based weights can be very similar despite relatively large interhospital differences in the total charges-to-operating cost ratio. The critical determining factor is the degree of similarity among hospitals' case mixes. On the one hand, if the proportion of cases in each DRG were the same for all hospitals, inter-DRG differences in the total charges-to-operating cost ratio would disappear, and charge-based and operating cost weights would be identical no matter how much variation exists in the ratio among hospitals. On the other hand, if hospitals were completely specialized, each treating a different set of DRG's, the interhospital differences would appear as inter-DRG differences, and charge-based and operating costs weights would reflect these differences.

Consider the following examples shown in Table 8. In each case, there are two hospitals and two DRG's. Hospital X has a total charges-to-operating cost ratio of 2.0, and hospital Y has a total charges-to-operating cost ratio of 1.0. In case A, hospitals X and Y each treat one case in each DRG. In case B, hospital X

Table 8

Impact of hospital differences in charge-to-cost ratios on diagnosis-related group relative weights

Case A

Item	DRG 1 Cost	DRG 1 Charges	DRG 1 Cases treated	DRG 2 Cost	DRG 2 Charges	DRG 2 Cases treated	Hospital charge-to-cost ratio
Hospital X	$100	$200	1	$200	$400	1	2.0
Hospital Y	100	100	1	200	200	1	1.0
Mean cost or charge per case	100	150	—	200	300	—	—
DRG charge-to-cost ratio		1.5			1.5		

Mean cost per case for all DRG's: $600 ÷ 4 = $150
Mean charges per case for all DRG's: $900 ÷ 4 = $225
Relative cost weights: $100 ÷ $150 = .667 (DRG 1)
$200 ÷ $150 = 1.33 (DRG 2)
Relative charge weights: $150 ÷ $225 = .667 (DRG 1)
$300 ÷ $225 = 1.33 (DRG 2)

Case B

Item	DRG 1 Cost	DRG 1 Charges	DRG 1 Cases treated	DRG 2 Cost	DRG 2 Charges	DRG 2 Cases treated	Hospital charge-to-cost ratio
Hospital X	$100	$200	2	—	—	0	2.0
Hospital Y	—	—	0	$200	$200	2	1.0
Mean cost or charge per case	100	200	—	200	200	—	—
DRG charge-to-cost ratio		2.0			1.0		

Mean cost per case for all DRG's: ((2 × $100) + (2 × $200)) ÷ 4 = $600 ÷ 4 = $150
Mean charges per case for all DRG's: ((2 × $200 + 2 x $200)) ÷ 4 = $800 ÷ 4 = $200
Relative cost weights: $100 ÷ $150 = .667 (DRG 1)
$200 ÷ $150 = 1.33 (DRG 2)
Relative charge weights: $200 ÷ $200 = 1.00 (DRG 1)
$200 ÷ $200 = 1.00 (DRG 2)

NOTE: DRG is diagnosis-related group.

treats two cases in DRG 1 and no cases in DRG 2. Hospital Y treats no cases in DRG 1 and two cases in DRG 2. Hence in case A, both hospitals X and Y have the same proportion of their cases in each DRG. In contrast, in case B, hospital X has 100 percent of its cases in DRG 1, whereas hospital Y has 100 percent of its cases in DRG 2. In case A, the interhospital differences in the total charges-to-operating cost ratio (2.0 versus 1.0) disappear at the DRG level, where the ratio is 1.5 for both DRG's. In turn, the charge-based and operating cost weights are identical. In case B, the interhospital differences in total charges-to-operating cost ratios (again 2.0 versus 1.0) appear at the DRG level also and, indeed, the charge-based and operating cost weights differ significantly. In particular, in case B the charge-based weights fail to capture the differences in resource intensity between the two DRG's.

These are the examples of the extreme cases. Clearly, the high degree of correspondence between the empirically derived charge-based and operating cost weights provides strong circumstantial evidence that the 1981 data lie closer on the spectrum to case A than to case B.

To explore this issue empirically, we computed the mean and standard deviation of the total charges-to-operating cost ratio by using the 1981 MEDPAR cases on which the DRG relative weights were based: across all hospitals with cases in the data set, and across the 358 DRG's included in our analysis. These means can be expressed, respectively, as

$$1/M\Sigma_j(\Sigma_i(n_{ij}/n_j)R_{ij}) \text{ and } 1/N\Sigma_i(\Sigma_j(n_{ij}/n_j)R_{ij}),$$

where

R_{ij} is the total charges-to-operating cost ratio for DRG i and hospital j;

(n_{ij}/n_j) is the proportion of cases in DRG i and hospital j;

(n_{ij}/n_j) is the proportion of cases in DRG i and hospital j;

M is the total number of hospitals; and

N is the number of DRG's (358 in our study).

The standard deviations are of particular interest because they measure the extent of variation in the ratios across DRG's and hospitals.

These results are presented in Table 9, and they show the large reduction in variation that occurs when

Table 9

Means and standard deviations of hospital and diagnosis-related groups charge and cost ratios by cost category: 1981

Category	Hospital	Diagnosis-related group
Total charges / Operating cost	1.34 (.25)	1.44 (.0025)
Total charges / Total cost	1.23 (.20)	1.26 (.0013)
Total cost / Operating cost	1.10 (.09)	1.14 (.0005)

NOTE: Standard deviations are shown in parentheses.

the ratio is computed by DRG rather than by hospital. The standard deviation of the total charges-to-operating cost ratio is only one-hundredth as large on a DRG basis as on a hospital basis. This result illustrates that the effect portrayed in case A of Table 8 is operating in the 1981 data and appears to explain why the charge-based and operating cost weights are very similar.

Compression of alternative relative weights

The finding that the charge-based weights are less compressed than the operating cost weights implies that the ratio of the two sets of weights tends to increase in moving from low-weight to high-weight DRG's. That is, for low-weight DRG's, the charge-based weights tend to be less than the operating cost weights; and for high-weight DRG's, the charge-based weights tend to be greater than the operating cost weights.

As noted earlier, it is shown in Table 9 that the inter-DRG variation in the total charges-to-operating cost ratio is small relative to the internospital variation (0.25 versus .0025). Nevertheless, some variation exists, and it holds the answer to the question of why the charge-based weights are less compressed than the operating cost weights. Our objective is to determine which of the adjustments made in constructing the operating cost weights accounts for these differences. Just as in the previous section, the issue is analyzed in terms of the total charges-to-operating cost ratio. The lesser compression of the charge-based weights implies that the total charges-to-operating cost ratio is positively correlated with the size of the operating cost weights.

This ratio can be expressed as the product of the following two ratios—the total charges-to-cost ratio and the total cost-to-operating cost ratio:

$$\frac{\text{Total charges per case}}{\text{Operating cost per case}} = \frac{\text{Total charges per case}}{\text{Total cost per case}} \times \frac{\text{Total cost per case}}{\text{Operating cost per case}}$$

The significance of this decomposition is that the component ratios reflect the adjustments for cost-to-charge ratios and pass-through costs whose effects we are attempting to determine. By examining how each of these ratios varies across DRG's, we can assess the effect of each adjustment. The standard deviations reported in Table 9 indicate that the total charges-to-total cost ratio is approximately 2½ times more variable across DRG's than the total cost-to-operating cost ratio (.0013 versus .0005). This fact suggests that cost-to-charge differences may be more likely to explain the lesser compression of charge-based weights than differences in pass-through costs are.

Table 10

Regressions of cost and charge ratios on operating cost weights for diagnosis-related groups

Dependent variables	Constant	Coefficient of operating cost weights	R^2
(1) Total charges-to-operating cost ratio	1.40	.0351 (13.0)	.32
(2) Total cost-to-operating cost ratio	1.13	.0096 (6.38)	.10
(3) Total charges-to-total cost ratio	1.24	.0200 (9.24)	.19
(4) CCP (Total charges-to-total cost ratio with mean charge-to-cost ratios and DRG-specific cost proportions)	1.23	.0221 (11.8)	.28
(5) CCR (Total charges-to-total cost ratio with DRG-specific charge-to-cost ratios and mean cost proportions)	1.25	.0052 (3.69)	.03

NOTES: DRG is diagnosis-related group.
t-statistics are shown in parentheses. The number of observations in all 5 equations is 358—the number of DRG's used throughout this analysis.

However, the critical question is whether the total charges-to-total cost ratio or the total cost-to-operating cost ratio increases more rapidly in going from low-weight to high-weight DRG's. We analyzed this question by regressing each of the three ratios on the operating cost weights, and the results are presented in lines (1)-(3) of Table 10. The positive slope coefficients indicate that both the total charges-to-total cost and the total cost-to-operating cost ratios contribute to the lesser compression of the charge-based weights.[4] However, the fact that the coefficient of the total charges-to-total cost ratio is twice as large

[4]Indeed, the fact that the slope coefficient and the R^2 are largest in the total charges-to-operating cost equation (row 1) indicates that the combined effects are stronger than either individual effect. Because the effects are multiplicative, this result is expected.

as the coefficient of the total cost-to-operating cost ratio (.02 versus .0096) indicates that differences between total charges and total costs are more important in explaining the compression result than inter-DRG differences in the pass-through costs are.

As a final step in our analysis, we attempted to determine why the total charges-to-total cost ratio tends to be greater (less) for high (low) weight DRG's. Variations in the total charges-to-total cost ratio result from variations in either the total charges-to-total cost ratios of the nine cost categories or the proportions of costs in each of the nine cost categories:

$$\left(\frac{\text{Total charges per case}}{\text{Total costs per case}}\right)_i = \sum_{j=1}^{9} \left(\frac{\text{Total charges}}{\text{Total cost}}\right)_{ij} \times \left(\frac{\text{Cost in category}}{\text{Total cost}}\right)_{ij}$$

The subscript i represents the DRG, and the subscript j represents the cost category. The following nine cost categories are the ones used in constructing the relative weights:

- Routine.
- Special care.
- Operating room.
- Drugs.
- Laboratory.
- X-ray.
- Medical supplies.
- Anesthesiology.
- Other ancillaries.

The total charges-to-total cost ratio of a DRG may be greater than the average for all DRG's because its specific charge-to-cost ratios are higher than average, or because it has above average proportions of total cost in cost categories that, on average, have relatively high charges-to-cost ratios. The means for the nine charges-to-cost ratios and cost proportions across DRG's are reported in Table 11.

To isolate the separate effects of differences in charges-to-cost ratios and differences in cost proportions, we computed two additional total charges-to-total cost ratios for each DRG, letting only one source of inter-DRG variation occur at a time. First, we computed one set of charges-to-cost ratios (*CCP*) using the mean charges-to-cost ratios for each of nine cost categories and the DRG-specific cost proportions. Then, we repeated the process using DRG-specific charges-to-cost ratios and nine mean cost proportions (CCR). CCP_i is the sum for each DRG across cost categories of the product of the mean charge-to-cost ratio for each cost category (CC_j) and the DRG-specific cost proportion (CP_{ij}); and CCR_i is the sum for each DRG across cost categories of the product of the DRG-specific charge-to-cost ratio (CC_{ij}) and the mean cost proportion for each cost category (CP_j). Thus, *CCP* reflects only inter-DRG variation in the proportions of total cost in each of the nine categories, whereas *CCR* reflects only inter-DRG variation in the charge-to-cost ratios for each category.

Table 11

Means and standard deviations of the total charges-to-total cost ratios and cost proportions, by cost category: 1981

Cost category	Total charges / Total cost	Cost in category / Total cost
Total	1.26	1.00
	(.0013)	—
Routine	1.05	.501
	(.0011)	(.0123)
Special care	.88	.060
	(.0073)	(.0036)
Operating room	1.19	.091
	(.0017)	(.0069)
Drugs	1.92	.068
	(.0064)	(.0007)
Laboratory	1.62	.088
	(.0018)	(.0005)
X-ray	1.38	.048
	(.0013)	(.0003)
Medical supplies	1.54	.052
	(.0042)	(.0007)
Anesthesiology	1.60	.014
	(.0511)	(.0001)
Other ancillaries	1.70	.078
	(.0056)	(.0010)

NOTES: DRG is diagnosis-related group. The means reported above are DRG-weighted means of the case weighted means for 358 DRG's. Standard deviations are shown in parentheses.

By regressing *CCP* and *CCR* on the operating cost weights, we determined which source of variation plays a greater role in explaining the lesser compression of the charge-based weights. The results of these regressions are shown in Table 10, lines (4) and (5). The slope coefficient is much larger in the *CCP* equation than in the *CCR* equation (.0221 versus .0052). This result indicates that inter-DRG variation in the proportion of cost in each of the nine cost categories explains most of the variation in the total charges-to-total cost ratio across DRG's. This result is further supported by the fact that the R^2 is much larger in the *CCP* than in the *CCR* equation (.28 versus .03).

Because, as shown in Table 11, the ancillary services, on average, have higher charges-to-cost ratios than routine and special care costs, we can draw the following inference: The lesser compression of the total charge weights results from the fact that higher (lower) weight DRG's tend to have higher (lower) proportions of their total costs in cost categories with relatively high (low) charges-to-cost ratios. Thus, in explaining the degree of compression that is the result of variation across DRG's in overall charges-to-cost ratios, inter-DRG variation in the proportions of costs in the various categories is more important than inter-DRG variation in the charges-to-cost ratios of the individual cost categories.

As a final comment on the compression issue, it should be noted that we found the pattern of charges-to-cost ratios among the nine cost categories to be

consistent with conventional beliefs about cross-subsidization. Ancillary cost categories have higher charges-to-cost ratios than the routine, special care, and operating room categories. Further, special care, which we might expect to be associated with high-weight DRG's, has the lowest charges-to-cost ratio. Other things being equal, we might expect DRG's with relatively high proportions of cost in special care to have lower charge-based weights than operating cost weights. However, other things are not equal. In particular, the relationship between the charge-based and operating cost weights for DRG's with above average proportions of special-care costs also depends on the correlations between the special-care proportion of cost and the other cost proportions.

We investigated this issue and found that the special-care proportion of total cost exceeds the DRG weighted mean of .06 for 123 of the 358 DRG's analyzed in this study. Eighty-four of the 123 DRG's had operating cost weights greater than 1.0. The charge-based weights are greater than the operating cost weights for 77 of these 84 DRG's. Thus, most relatively high-weight DRG's with an above average proportion of special-care cost fit the general pattern of lesser compression for the charge-based weights. For these DRG's, cross-subsidization of special care, as reflected in a relatively low ratio of charges-to-cost, does not result in compression of the charge-based weights relative to the operating cost weights. This result can only be explained by the existence of a positive correlation between the proportions of cost in special care and in the ancillary categories with higher charges-to-cost ratios. In other words, a high proportion of special-care cost does not generally compress the charge-based weight for a DRG because relatively high utilization of special care is accompanied by relatively high utilization of ancillaries, such as X-ray and laboratory services.

Relationship between cost and case-mix

An important step in the development of the original set of cost-based relative weights was an assessment of the relationship between hospital case-mix index values constructed from the cost-based relative weights and hospital average per case values. The relationship between case mix and cost per case was tested by estimating a single equation average cost function using 1981 Medicare Cost Report data from approximately 5,000 hospitals. The analysis supported the hypothesis that a case-mix index based on operating cost weights is a significant factor that explains variation in average Medicare cost per case among hospitals, and that such a case-mix index provides a valid representation of the expected costliness of an individual hospital's Medicare patient mix. In this section, we replicate the original analysis by using a case-mix index constructed from charge-based relative weights, rather than from operating cost weights, and compare the results with the original findings.

The evaluation of case mix and Medicare cost per case was based on the multivariate regression analysis of hospitals' 1981 operating costs per case. Cost per case is hypothesized to depend on the following independent variables:

- The charge-based Medicare case-mix index.
- A 1981 Bureau of Labor Statistics wage index.
- A measure of teaching activity (resident-to-bed ratio).
- Bed size.
- A set of locational dummy variables (three standard metropolitan statistical area size categories and one rural category).

With the exception of the location variables, all variables were transformed to logarithms in the estimated equation; and for these transformed variables, the regression coefficients are interpretable as elasticities (i.e., the coefficients are estimates of the percent change in the dependent variable resulting from a 1-percent change in the independent variable).

The estimated coefficients and associated *t*-statistics for the regression results based on charge-based and cost-based case-mix index values are given in Table 12. The coefficient values are quite similar for both sets of regression results. The case-mix coefficient and the teaching activity coefficient are slightly lower when the charge-based case-mix index is used, but they are not significantly different from the coefficients obtained using the cost-based, case-mix index (evaluated in a two-tailed test at the 5-percent level of significance). The other coefficient values remain essentially unchanged. More importantly, after controlling for other factors that influence hospital costs, the coefficient of the charge-based case-mix

Table 12

Regression results using charge-based and cost-based case-mix indexes in a single equation average cost function

Variable	Coefficient	*t*-Statistic
	Results using charge-based case-mix index	
Case-mix index	.969	23.4
Wage index	1.022	27.5
Resident to bed ratio	.545	11.9
Bed size	.117	23.8
Large city dummy	.109	7.8
Medium city dummy	.025	2.2
Small city dummy	.000	0.0
Constant	7.334	—
Adjusted R^2 = .72		
Standard error of estimate = .22		
	Results using cost-based case-mix index	
Case-mix index	1.012	23.3
Wage index	1.023	27.5
Resident to bed ratio	.580	12.7
Bed size	.119	24.4
Large city dummy	.109	7.8
Medium city dummy	.026	2.3
Small city dummy	.001	0.0
Constant	7.322	—
Adjusted R^2 = .72		
Standard error of estimate = .22		

index was not significantly different from 1.0 (evaluated in a two-tailed test at the 5-percent level of significance). Hence, the charge-based case-mix index is approximately proportional to the expected costliness of an individual hospital's Medicare patient mix, as was the case for the cost-based case-mix index. This result further supports the finding that there do not appear to be large, arbitrary differences between charge-based and cost-based weights or between case-mix indexes constructed from charge-based and cost-based weights.

Summary

The original relative weights used in the prospective payment system (PPS) were based on standardized cost data for a sample of 1981 Medicare discharges. Cost-based relative weights were used in the PPS on the assumption that they would better reflect differences in true resource costs among diagnosis-related groups (DRG's) than relative weights based on charges would. The extent to which relative weights based on costs differ from relative weights derived exclusively from charge data and the sources of any differences were investigated in this study. Also, the validity of a case-mix index developed from charge-based relative weights as a measure of the relative costliness of a hospital's Medicare cases was assessed.

The results of the analysis indicate that charge-based and operating cost weights based on 1981 MEDPAR data are very similar. A summary of the major findings is as follows:

- The difference between relative weights based on operating costs and relative weights based on total charges is less than 5 percent for most of the DRG's.
- The structure of the relative weights across DRG's for each method are nearly identical. The Spearman and Pearson correlation coefficients are greater than .99.
- The relative dispersion of costs or charges within a DRG are very similar, although for most DRG's the coefficients of variation using charge data are slightly higher than the coefficients of variation using cost data.
- The dispersion of average costs or charges across DRG's are also very similar. However, DRG's with high (low) relative weights tend to have slightly higher (lower) relative weights if computed using charge data rather than cost data, which means that the charge-based relative weights are slightly less compressed than the cost-based relative weights.
- Large urban hospitals and teaching hospitals tend to have slightly higher case-mix index values using charge-based weights rather than cost based weights, whereas small rural hospitals and nonteaching hospitals tend to have slightly lower case-mix index values using charge-based weights. This finding is a consequence of the finding that charge-based weights are slightly less compressed than the cost-based weights.

The results of the analysis support the use of charge data in constructing DRG relative weights. In particular, interhospital differences in cost-to-charge ratios do not result in large, arbitrary differences between charge-based and operating cost weights. Whether the data are standardized for differences in capital and medical education cost also appears to make little difference. These interhospital differences only affect the DRG relative weights if there is a high degree of specialization among hospitals in different groups of DRG's. Our results indicate that, in 1981, hospitals' case mixes were similar enough so that most interhospital effects disappear when the data are partitioned by DRG.

However, as noted previously, we found that charge-based weights are somewhat less compressed than cost-based weights. This result is contrary to the expectation that cross-subsidization by hospitals in their pricing of high-cost and low-cost services would make charge-based weights more compressed than operating cost weights. In seeking an explanation for the observed result, we found the pattern of charge-to-cost ratios among the cost categories used in constructing the relative weights to be consistent with the cross-subsidization hypothesis. However, the relative importance of these costs categories varies across DRG's in a way not accounted for by the cross-subsidization hypothesis. On the one hand, high-cost services such as special care have lower charge-to-cost ratios than ancillary services such as drugs and laboratory. On the other hand, high-weight DRG's with a relatively high proportion of special-care cost also have relatively high proportions of other ancillaries. The net effect of these relationships is to make the charge-based weights less compressed than the operating cost weights.

Finally, we analyzed the relationship between hospitals' case-mix index values constructed from the charge-based relative weights and average Medicare cost per case based on multivariate regression analysis of hospitals' 1981 operating costs per case. The charge-based case-mix index was found to be proportional to the expected costliness of an individual hospital's Medicare patient mix. This result further supports the study's major finding that there do not appear to be large differences between charge-based and cost-based weights or between case-mix indexes constructed from charge-based or cost-based weights.

Although the differences between charge-based and cost-based weights are small, our analysis does not necessarily imply that charges are a good measure of the resources used to treat hospital inpatients. However, it would appear that, based on our analysis, charge-based relative weights are a viable alternative to operating-cost weights constructed according to the methodology originally used in the PPS.

References

Federal Register: Medicare Program prospective payments for Medicare inpatient hospital services. Vol. 48, No. 171, Sept. 1, 1983.

Lave, J.: Is compression occurring in DRG prices? *Inquiry* 22(2):143-144. Summer 1985.

Pettengill, J., and Vertrees, J.: Reliability and validity in hospital case-mix measurement. *Health Care Financing Review*. Vol. 4, No. 2. HCFA Pub. No. 03149. Office of Research and Demonstrations. Health Care Financing Administration. Washington. U.S. Government Printing Office, Dec. 1982.

Changes in distribution of Medicare expenditures among aged enrollees, 1969-82

by Gerald Riley, James Lubitz, Ronald Prihoda, and Mary Ann Stevenson

In this article, we examined the concentration of Medicare expenditures among the aged for 1969, 1975, and 1982 to determine if expenditures have become more concentrated among a few heavy users of service over time. Despite an increase in reimbursements for the aged from $6.0 billion in 1969 to $41.8 billion in 1982, the distribution of those expenses remained remarkably stable, with a slight lessening in the concentration of reimbursements in 1982. Patterns were similar for both Part A (hospital insurance) and Part B (supplementary medical insurance) services. The concentration of expenditures was much greater among survivors than among people who died in both 1975 and 1982, with little change in the distribution of expenditures within either group.

Introduction

Data from the Medicare program have long shown that expenditures, and particularly hospital expenses, tend to be heavily concentrated among a small number of people who are heavy users of services. The question often arises as to whether Medicare expenditures for the aged have become more concentrated among a few heavy users of services over time. Shifts in the concentration of Medicare expenditures over time are of interest for several reasons. A trend toward a greater concentration of expenditures would reveal that the highest cost individuals are an important source of increased program expenses. This would suggest that cost-containment efforts should focus on the care given to these individuals. Trends in the distribution of expenditures among enrollees may also provide insights into the impact of new, high-cost technologies such as coronary artery bypass surgery, computerized axial tomography (CAT) scans, maintenance dialysis for end-stage renal disease, and hip replacement. The use of more sophisticated techniques for prolonging the lives of extremely ill patients (often referred to as "heroic" measures) would likely produce more high-cost individuals and could affect the distribution of expenditures. The increase in Medicare's End-Stage Renal Disease (ESRD) population has produced some new high-cost enrollees, although the number of aged ESRD enrollees is still not great.[1] Cost sharing also becomes a crucial issue for high-cost individuals through deductible and coinsurance obligations. It may be desirable to restructure Medicare cost-sharing requirements to lessen the burden for certain kinds of high-cost individuals. For example, Gornick, Beebe, and Prihoda (1983) estimated that a $161 surcharge per enrollee in 1984 would have permitted a cap of $400 on beneficiary liability for deductible and coinsurance expenses.

Studies of the aged population have illustrated the concentration of expenditures among a small percent of users. Gornick, Beebe, and Prihoda (1983) determined that, in 1980, 14.1 percent of aged Medicare enrollees incurred $2,000 or more in reimbursed expenses, and they accounted for 83.7 percent of total expenditures. A large portion of Medicare expenditures are attributable to patients who are terminally ill. Lubitz and Prihoda (1984) investigated Medicare expenses incurred in the last 12 months of life for beneficiaries who died in 1978. They found that decedents comprised 5.9 percent of the Medicare aged population, but accounted for 27.9 percent of expenditures. They also found that the ratio of per capita reimbursements of decedents to survivors increased only slightly from 1967 to 1979 (4.9 percent to 5.1 percent). Birnbaum (1978) determined that, in 1974, 2.9 percent of the aged noninstitutionalized population (including those not entitled to Medicare) incurred 34 percent of total health care expenses for the noninstitutionalized aged.

Other studies not limited to the aged population also showed a concentration of expenses among a small percent of users. The Congressional Budget Office (1982) studied the health care expenses of families enrolled in the Federal Employees' Health Benefit Plan (FEHBP) through Blue Cross and Blue Shield, and found that in 1978 the costliest 5 percent of families accounted for 49 percent of medical expenses. Schroeder, Showstack, and Roberts (1979) studied 17 acute care hospitals in the San Francisco Bay area and found that the percent of patients whose yearly hospital charges exceeded $4,000 in 1976 ranged from 4 percent to 24 percent, and that these patients accounted for 20 percent to 68 percent of total yearly charges for these hospitals. Zook and Moore (1980) studied patients in six hospitals in 1976 and found that, on average, 13 percent of patients accounted for one-half of inpatient charges. Based on these data, they estimated that as few as 1.3 percent of the general population consumes more than one-half of the hospital resources used in any given year. Zook and Moore (1980) also found that persons 65 years of age or over were disproportionately represented among high-cost users.

[1] In 1976 and 1982, ESRD patients comprised .015 percent and .036 percent of the aged population, respectively. Yet these small numbers of beneficiaries accounted for .52 percent and .68 percent of all Medicare expenditures on the aged in 1976 and 1982, respectively.

Reprint requests: Gerald Riley, Health Care Financing Administration, 2-C-15 Oak Meadows Building, 6325 Security Boulevard, Baltimore, Maryland 21207.

Some studies not limited to the Medicare population have shown increases in the concentration of health expenditures over time. Andersen, Lion, and Anderson (1976), using data from interviews taken from probability samples of the noninstitutionalized population of the United States, found that, in 1963, the top 1 percent of users (in terms of expenditures) accounted for 17 percent of the total amount spent for nonfree health services. By 1970, they accounted for 23 percent of expenditures for nonfree care, excluding Medicare (24 percent including Medicare). The proportion of total expenditures accounted for by the top 5 and 10 percent of users also increased, but less dramatically. The Congressional Budget Office Report (1982) noted that the percent of expenses accounted for by the top 1 percent of families enrolled in Blue Cross and Blue Shield's FEHBP program increased from 20 percent to 22 percent between 1974 and 1978.

This article examines trends in the distribution of Medicare expenditures by comparing the concentration of expenditures among aged Medicare enrollees in 1969, 1975, and 1982. Trends are examined separately for Part A (hospital insurance), and Part B (supplementary medical insurance) of Medicare. Trends are also examined separately for decedents and survivors. The distribution of health care charges for aged persons in 1980 is also compared with that of persons under age 65, as reported by the National Medical Care Utilization and Expenditure Survey.

In analyzing the distribution of expenditures, some of the studies cited previously have been based on the entire population at risk, and others have based the analysis on the population of users of services. In studying trends in the concentration of expenditures, the results can differ depending on which population is studied. All our analyses are based on the entire population at risk rather than only the population of users.

Data and methods

The major focus of this article is on changes in the percent of reimbursements attributable to various percentiles of all aged enrollees. The data were derived from the Medicare Person Summary File, which consists of Medicare claims submitted for a 5-percent sample of the enrolled aged population. The records are organized on a person basis so that all covered services received by each sample individual are put into a single record. This analysis covers the years 1969, 1975, and 1982 so that long-term changes in expenditure patterns can be identified. For 1969, only published data were available (Office of Research and Statistics, 1975) showing numbers of persons served and total dollars associated with broad reimbursement categories (e.g., less than $50, $50-$99, etc.). The published data were used to compute a limited number of cumulative percentages of beneficiaries and reimbursement amounts. For 1975 and 1982, individual claim files were available, and consequently cumulative dollars could be calculated for a number of selected beneficiary percentile levels. The same cumulative percentages of beneficiaries derived from the 1969 data were used for 1975 and 1982 to facilitate comparisons of these years. In addition, reimbursements were computed for the top 10, 5, 1, and .1 percent of beneficiaries in 1975 and 1982. Separate computations were also prepared for survivors and decedents in 1975 and 1982.

Changes in the distribution of Part B reimbursements are influenced by the rise in the annual Part B deductible over time. The Part B deductible was $50 in 1969 and was raised to $60 in 1973, where it remained until 1982 when it rose to $75. The increase in the price of Part B services was more rapid than the increase in the Part B deductible; therefore, more people became eligible for Part B reimbursement over time because fewer units of service were required to exceed the deductible. This phenomenon can, to some extent, affect the entire distribution of Part B and, therefore, total expenditures because of an increasing number of low-service users with reimbursements barely exceeding the deductible. Part A expenses are not affected by this phenomenon because the deductible for hospital services changes annually in accordance with the average daily cost of hospital care. Thus, unlike Part B, there is no artificial shift in the concentration of Part A reimbursements caused by an increasing number of beneficiaries exceeding a constant deductible.

To control the "deductible effect," all Part B reimbursements for 1975 and 1982 were adjusted to account for the lag in the change of the Part B deductible, after which the cumulative distributions were recomputed. Specifically, individual Part B reimbursements for 1975 and 1982 were reduced to simulate what they would have been if the Part B deductible had risen with inflation. The adjustment was made using the yearly net increase in reasonable charges for physicians' services, per enrollee, because of price changes since 1969 (Board of Trustees, Federal Supplementary Medical Insurance Trust Fund, 1983; Kunkel, 1984). Price increases for physicians' services were used because they represent the bulk of Part B services; net increases in reasonable charges were examined, rather than increases in submitted charges, because the deductible is applied to reasonable charges.

If the 1969 Part B deductible had increased at the same rate as the price of Part B services, the deductible would have risen to $65.09 in 1975. The actual deductible for that year was $60. Therefore, all individual Part B reimbursements for 1975 were reduced by $5.09 to simulate what Part B reimbursements would have been under a $65.09 deductible. The distribution of expenditures was then recomputed, using the adjusted reimbursement amounts. Similarly, it was estimated that the 1982 Part B deductible would have been $120.15 if the deductible had risen with inflation in previous years. The actual deductible for that year was $75.

Therefore, all individual Part B reimbursements for 1982 were reduced by $45.15. The distribution of expenditures for 1982 was then recomputed, using the adjusted reimbursement amounts.

In this article we also compare the distribution of charges for health services received by persons 65 years of age or over with that of persons under 65 years of age using data reported by Garfinkel, Riley, and Iannacchione (1985). This comparison uses interview data obtained through the National Medical Care Utilization and Expenditure Survey. This is a survey of a national probability sample of the noninstitutionalized United States population, conducted in 1980, which recorded health care charge and utilization data. The charge data were obtained directly from respondents. If the respondent did not know the charge for a given service, a charge per service was imputed from data provided by another respondent matched on demographic characteristics. Charge data for Medicaid-eligible respondents were imputed in every case based on their reported utilization. As a result, subsequent comparisons between expenditure distributions of Medicaid and non-Medicaid eligibles reflect differences in the distribution of utilization between these groups rather than differences in the distribution of charges, per se.

Results

The degree of concentration of Medicare reimbursements among heavy users of services exhibited considerable stability over time (Table 1). The table, which does not include the adjustment for Part B expenses, indicates the percent of reimbursements attributable to a given percent of the highest cost beneficiaries, for all services and for Parts A and B services separately. (The choice of percentiles other than those ending in .5 or .0 was dictated by those calculated from the published reimbursement data available in 1969. No data tape was available for that year to enable computation of percent of reimbursement for other enrollee percentiles.) It is evident that the distributions of expenditures for 1969 and 1975 are similar, particularly for Part A and for total dollars. For example, the top 4 percent of enrollees accounted for 50.1 percent of all reimbursements in both 1969 and 1975. The top 2 percent accounted for 33.0 percent of all reimbursements in 1969 and 33.5 percent in 1975. In 1982, reimbursements exhibited a slightly smaller concentration at all levels when compared with 1969 and 1975. For example, the costliest 4 percent of enrollees in 1982 accounted for 47.9 percent of total expenses, compared to 50.1 percent in the other years. This stability is quite remarkable, given the fact that overall program expenses for the aged increased from $6.0 billion in 1969 to $12.7 billion in 1975 and to $41.8 billion in 1982.

The decrease in concentration of expenses in 1982 was considerably less for Part A than for Part B. For example, for Part A, the top 4.1 percent of beneficiaries accounted for 55.6 percent of expenditures in 1982 compared with 57.2 percent for the other 2 years. For Part B, the top 4.6 percent of enrollees accounted for 41.9 percent of expenses in 1982, 44.7 percent in 1975, and 46.4 percent in 1969.

Table 1

Percent of Medicare reimbursements attributable to the highest cost groups of aged enrollees: 1969, 1975, and 1982

Enrollee upper percentile	1969	1975	1982
	Percent of reimbursements		
Total			
11.0	81.4	80.3	77.1
8.8	74.4	73.6	70.6
5.8	61.4	61.1	58.4
5.0	(1)	56.5	54.0
4.0	50.1	50.1	47.9
2.8	40.6	40.9	39.1
2.0	33.0	33.5	31.9
1.0	(1)	21.4	20.3
0.5	(1)	13.3	12.5
Part A			
8.5	80.4	79.8	77.7
6.6	72.1	71.7	69.7
5.0	(1)	63.1	61.3
4.1	57.2	57.2	55.6
2.7	45.3	45.6	44.3
1.8	35.6	36.2	35.1
1.3	28.0	28.6	27.8
1.0	(1)	24.5	23.7
0.5	(1)	15.3	14.7
Part B			
12.6	77.0	73.3	69.6
8.8	65.8	62.7	59.0
6.3	55.6	53.3	50.0
5.0	(1)	47.0	44.1
4.6	46.4	44.7	41.9
2.2	29.0	28.6	27.1
2.0	(1)	27.3	25.8
1.1	18.2	18.4	17.5
1.0	(1)	17.5	16.7
0.5	(1)	11.0	10.7

[1] Not available for 1969.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System.

The stability in the concentration of Part A reimbursements from 1969 to 1982 may be an artifact of the manner in which inpatient hospital expenses were reimbursed before the implementation of prospective payment in 1983. Under cost reimbursement, hospitals normally received an interim payment for each bill based on a percent of charges or on a standard per diem amount. This interim payment was recorded in the Medicare Person Summary File, which was used for this study. For expensive hospitals stays (e.g. for a coronary artery bypass operation) an interim payment based on a per diem amount would normally underestimate the amount of hospital resources expended because the cost of additional ancillary services used would be spread across all Medicare hospital days. Because the number of hospitals receiving per diem-based interim payments increased over time (Goldstein, 1985), there may have been an increase in the extent to which the

cost of expensive hospital stays was not reflected in reimbursement figures based on billing data. This in turn may have caused Part A expenditures to appear to have become less concentrated among a small percent of enrollees over time.

We examined the effect of the change in the interim payment method by computing cumulative enrollee and dollar levels for Medicare-covered Part A charges in 1975 and 1981 using the Continuous Medicare History Sample (CMHS). The CMHS is a longitudinal research file containing data on a 5-percent sample of the Medicare population. Data from 1981 were used because 1982 data are not available in the CMHS; in addition, a 1-percent subsample was used in computing the distribution of 1975 Part A charges because of data availability limitations. The similarity in the distribution of Part A charges in 1975 and 1982 confirms the stability in the concentration of Part A expenses over time (Table 2). The charge data show a slight increase in concentration over time in the 5.0 and 1.0 enrollee percentiles, in contrast to the slight lessening shown in Part A reimbursement data in Table 1. Part A reimbursements exhibited a similar, though slightly heavier concentration, than did Part A charges in 1975.

The cumulative distributions of Part B and total expenditures were also computed after applying the inflation adjustment procedure for the deductible described in the "Data and methods" section. The adjustment makes only a small difference in the concentration of total expenditures (Table 3). The 1975 and 1982 distributions of Part B and total expenditures become slightly more concentrated after the adjustment, but the same basic patterns remain. The distributions for the 3 study years remain similar, with a slightly less heavy concentration of expenditures in 1982 than in the other 2 years. For example, the costliest 4.6 percent of beneficiaries used 46.4 percent, 45.3 percent, and 44.0 percent of Part B expenditures in 1969, 1975, and 1982 respectively.

The similarity of the adjusted expenditure distributions among the 3 study years is illustrated through Lorenz curves (Figure 1) which are graphs of the cumulative percent of enrollees versus the cumulative percent of reimbursements associated with them. The further the curve deviates from a 45 degree line the more skewed is the distribution of reimbursements, and hence the more heavily concentrated are the expenditures among a relatively few beneficiaries. As seen from the figure, the distribution of adjusted total reimbursements for all 3 years are heavily skewed and are similar to each other, particularly among the upper percentiles of enrollees.

One aspect of the distribution of Medicare expenditures is the percent of enrollees with some Medicare reimbursements in a given year. The percent incurring reimbursements has increased substantially over time (Table 4). Only 40.3 percent of beneficiaries incurred reimbursements under Part A and/or Part B in 1969, but 61.1 percent did so in 1982. Although much of this increase is because of the slowness of the

Table 2

Percent of covered Part A charges attributable to the highest cost groups of Medicare aged enrollees: 1975 and 1981

Enrollee percentile	1975[1]	1981[2]
	Percent	
10.0	80.2	79.6
5.0	58.9	59.1
1.0	22.9	23.4

[1]Based on a 1-percent sample.
[2]Based on a 5-percent sample.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System.

Table 3

Percent of Medicare reimbursement attributable to the highest cost groups of aged enrollees, with Part B deductible adjusted for inflation: 1969, 1975, and 1982

Enrollee upper percentile	1969	1975	1982
	Percent of reimbursements		
Total			
11.0	81.4	80.6	78.1
8.8	74.4	73.9	71.5
5.8	61.4	61.3	59.3
5.0	(1)	56.7	54.8
4.0	50.1	50.3	48.6
2.8	40.6	41.1	39.7
2.0	33.0	33.6	32.4
1.0	(1)	21.5	20.7
0.5	(1)	13.3	12.7
Part B			
12.6	77.0	74.2	72.5
8.8	65.8	63.5	61.7
6.3	55.6	54.0	52.4
5.0	(1)	47.6	46.2
4.6	46.4	45.3	44.0
2.2	29.0	29.0	28.5
2.0	(1)	27.7	27.2
1.1	18.2	18.5	18.5
1.0	(1)	17.7	17.6
0.5	(1)	11.2	11.3

[1]Not available for 1969.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System.

Table 4

Percent of Medicare aged enrollees with some reimbursement, by type of service: 1969, 1975, and 1982

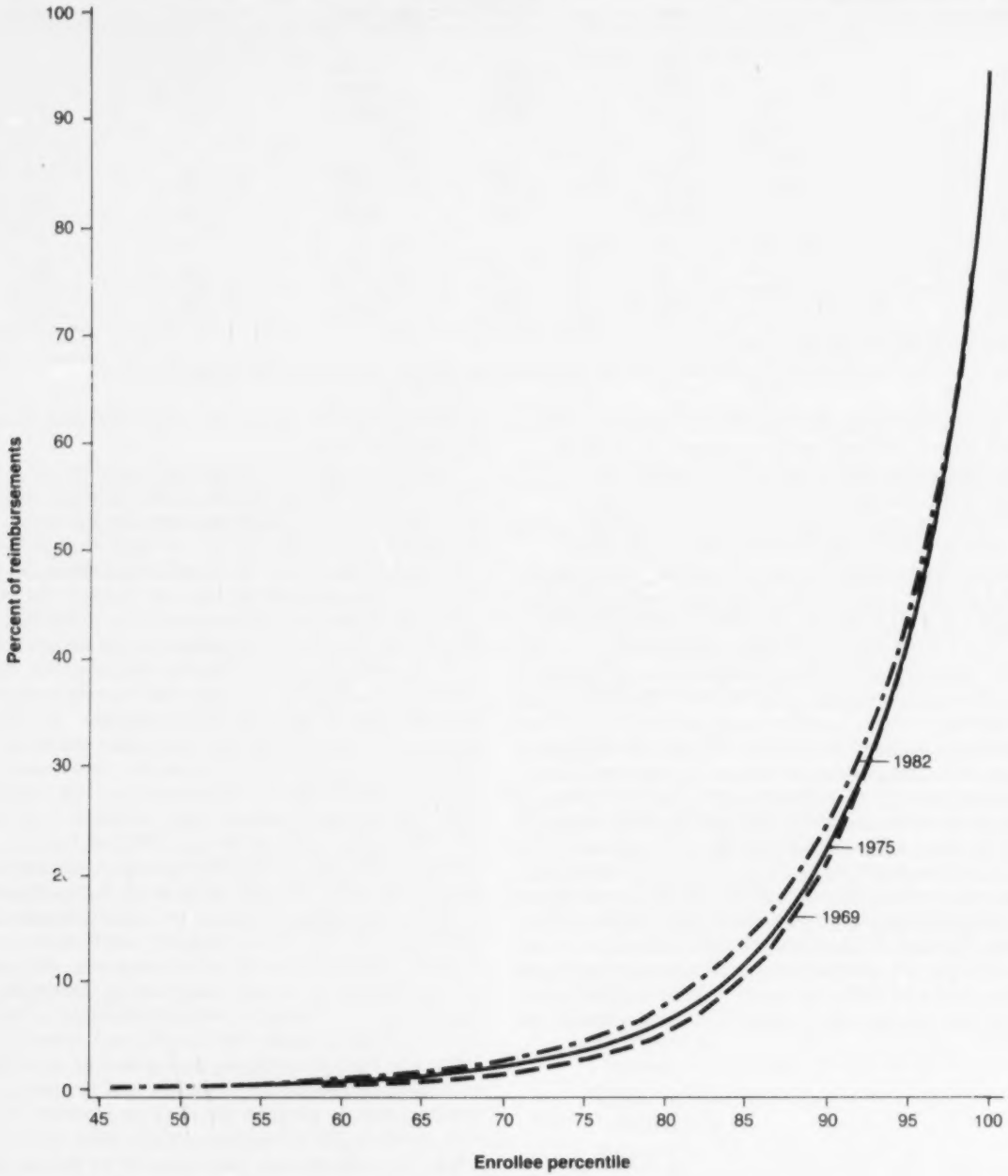
Type of service	1969	1975	1982
	Percent incurring reimbursement		
Actual			
Part A and/or Part B	40.3	49.9	61.1
Part A	19.7	20.9	23.8
Part B	40.4	50.6	62.2
Adjusted[1]			
Part A and/or Part B	40.3	48.7	53.5
Part B	40.4	49.3	54.0

[1]Part B deductible adjusted for inflation.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System.

Figure 1

Cumulative percent of reimbursements attributable to various percentiles of aged Medicare enrollees: 1969, 1975, and 1982



NOTE: The Part B deductible has been adjusted for inflation.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System.

Table 5

Per capita reimbursements for highest cost Medicare aged beneficiaries: 1969, 1975, and 1982

Enrollee percentile	Per capita reimbursements			Average annual percent increase	
	1969	1975	1982	1969-75	1975-82
Total					
All aged	$280	$524	$1,469	11.0	15.9
Top 4.0	3,521	6,602	17,897	11.0	15.3
Top 2.0	4,618	8,802	23,818	11.3	15.3
Part A					
All aged	201	387	1,067	11.5	15.6
Top 4.1	2,797	5,377	14,393	11.5	15.1
Top 1.8	3,900	7,609	20,331	11.8	15.1
Part B					
All aged	84	147	433	9.8	16.7
Top 4.6	856	1,460	4,167	9.3	16.2
Top 2.2	1,134	1,978	5,702	9.7	16.3

NOTE: Part B deductible is adjusted for inflation.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System.

rise in the Part B deductible, relative to inflation, the adjusted figures on total reimbursements in Table 4 indicate that there would have been a substantial increase in the number of beneficiaries receiving reimbursements even without the deductible effect (from 40.3 percent in 1969 to 53.5 percent in 1982). The largest increase was in Part B services, where the adjusted percent of enrollees incurring reimbursements increased from 40.4 percent in 1969 to 54.0 percent in 1982.[2] For Part A there was also a substantial increase from 19.7 percent to 23.8 percent, reflecting the increase in the number of enrollees who were hospitalized.

A different perspective on expenditure distributions is obtained by comparing the rate of increase in reimbursements for the costliest beneficiaries to the rate of increase for the aged Medicare population in general (Table 5). As indicated in the table, the per capita reimbursements of the heavy users increased at approximately the same average annual rate as the per capita reimbursements for the entire aged population between 1969 and 1975, with a slightly greater increase in Part A expenses among the heaviest users. Between 1975 and 1982, the costliest beneficiaries exhibited similar but slightly smaller increases under both Part A and Part B relative to all beneficiaries. (Part A reimbursements for the top 1.8 percent of beneficiaries increased an average of 15.1 percent annually compared with a 15.6-percent annual average increase for all Part A enrollees; Part B reimbursement for the top 2.2 percent increased an average of 16.3 percent annually versus a 16.7-percent average annual increase for all Part B enrollees.) Consequently there is no evidence of a general shift toward a heavier concentration of expenses among a few beneficiaries. The data in Tables 1 through 5 suggest that the increase in expenses of low and moderate users of service has kept pace with those of the heaviest users.

These findings differ somewhat from those of the Congressional Budget Office (CBO) Report, which contained data on family expenses for Federal employees covered by Blue Cross and Blue Shield in 1974 and 1978. The CBO specifically looked at expenses that exceeded certain catastrophic thresholds. The CBO report noted that expenditures for high-cost illness rose faster than expenditures for all covered services, although the difference was relatively small. CBO also found that the disproportionate growth in expenditures for high-cost illness did not contribute much to the overall increase in medical expenses. We conducted an analysis similar to that performed by CBO for Medicare reimbursements in 1969, 1975, and 1982, using several catastrophic thresholds that ranged (in 1969 dollars) from a low of $500 for Part B expenses to a high of $3,000 for total Medicare reimbursements. The threshold levels were adjusted to account for changes in Medicare reimbursement per enrollee over time. We found that for Part A reimbursements and total reimbursements, the percent of beneficiaries exceeding catastrophic thresholds, and the percent of reimbursements attributable to them, declined slightly from 1969 to 1975 and from 1975 to 1982. For Part B expenses, the percent of beneficiaries exceeding catastrophic thresholds, and the percent of reimbursements attributable to them, declined slightly from 1969 to 1975, but rose slightly from 1975 to 1982. The difference in findings may be due to the fact that our data pertain to the aged only, whereas the CBO report includes families enrolled in the FEHBP, most of whose members are under 65 years of age. Another reason may be that the CBO report looked at a different and shorter time period than we did.

It is known that a large portion of expenditures under Medicare are associated with persons who are in their last year of life (Lubitz and Prihoda, 1984).

[2]The Part B deductible carryover provision helped beneficiaries meet the Part B deductible before it was eliminated in 1980.

Table 6

Percent of Medicare reimbursements attributable to the highest cost groups of aged enrollees, by survival status: 1975 and 1982

Enrollee upper percentile	Survivors		Decedents	
	1975	1982	1975	1982
	Percent of reimbursements			
Total				
10.0	79.5	76.7	45.8	42.9
5.0	58.8	56.6	29.4	27.3
2.0	35.3	34.0	15.7	14.4
1.0	22.8	21.9	9.5	8.7
0.5	14.2	13.6	5.6	5.3
Part A				
10.0	87.8	85.3	47.1	44.3
5.0	66.4	64.2	30.5	28.3
2.0	40.7	39.4	16.3	15.0
1.0	26.5	25.6	9.9	9.2
0.5	16.7	16.1	5.9	5.6
Part B				
10.0	68.2	66.6	49.3	45.5
5.0	48.6	47.2	32.4	29.9
2.0	28.3	27.9	17.9	16.6
1.0	18.2	18.1	11.2	10.5
0.5	11.5	11.7	7.1	6.5

NOTE: Part B deductible is adjusted for inflation.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System.

Distributions of expenditures for 1975 and 1982 were computed separately for enrollees who died in those years and for those who survived (Table 6). Unlike the Lubitz and Prihoda study, which examined expenses in the last 12 months of life, data on decedents in this present study were limited to expenses in the calendar year in which the enrollee died. We found that expenditures were much more concentrated among survivors than decedents because a relatively high proportion of decendents use a large amount of services. In 1982, the top 5 percent of survivors accounted for 56.6 percent of total reimbursements, whereas among decedents the top 5 percent accounted for only 27.3 percent of reimbursements. There was some lessening in the concentration of Part A and Part B expenditures between 1975 and 1982 for both survivors and decedents, although the reduction in concentration tended to be proportionately greater among decedents, particularly for Part B services. For example, the costliest 5 percent of survivors under Part B accounted for 48.6 percent of total expenditures in 1975 and 47.2 percent in 1982, whereas the costliest 5 percent of decedents accounted for 32.4 percent of expenditures in 1975 versus only 29.9 percent in 1982.

Because the cost of treating illness in the last year of life accounts for such a large portion of program expenditures (Lubitz and Prihoda, 1984), it is important to know whether expenses attributable to decedents are rising faster than those of survivors. Table 7 shows the ratio of per capita reimbursements for decedents to those for survivors for the years 1967, 1975, 1979, and 1982. The ratio dropped slightly (from 4.86 to 4.75) between 1967 and 1975, then rose slightly after that (5.05 in 1982). Generally, the ratio of decedent to survivor per capita reimbursements remained quite stable for Part A, Part B, and total reimbursements. Table 8 compares the average annual increase in per capita reimbursements attributable to decedents and survivors from 1967 to 1982, using two sources of published Medicare data (Helbing, 1983; Piro and Lutins, 1973). As indicated in the table, per capita reimbursements for survivors rose slightly more than those for decedents from 1967 to 1975 (12.7 versus 12.4 percent annually). From 1975 to 1979 per capita reimbursements for decedents increased at a somewhat faster rate (16.8 percent versus 14.9 percent annually), but increased at approximately the same rate from 1979 to 1982. The findings summarized in Tables 7 and 8 suggest that per capita expenses incurred by decedents and survivors have increased at similar rates, and the slightly more rapid rise in expenditures for decedents in some recent years has not had a

Table 7

Ratio of Medicare aged per capita reimbursements, decedents to survivors: Selected years 1967-82

Year	Total	Part A	Part B
	Ratio of per capita reimbursements		
1967	4.86	5.78	2.97
1975	4.75	5.59	2.69
1979	5.07	6.04	2.84
1982	5.05	6.03	2.93

NOTE: Data for decedents are based on the calendar year in which the enrollee died.

SOURCE: Health Care Financing Administration; (Piro and Lutins, 1973; Helbing, 1983). Data for 1975 and 1982 are from the Medicare Statistical System data for the present study.

Table 8

Average annual percent increase in per capita reimbursements for Medicare aged decedents and survivors: Selected years 1967-82

Year	Total		Part A		Part B	
	Decedents	Survivors	Decedents	Survivors	Decedents	Survivors
	Average annual percent increase					
1967-75	12.4	12.7	13.0	13.5	10.6	12.0
1975-79	16.8	14.9	16.3	14.0	19.7	18.1
1979-82	17.4	17.6	17.4	17.4	17.4	16.2

NOTE: Data for decedents are based on the calendar year in which the enrollee died.

SOURCE: Health Care Financing Administration; (Piro and Lutins, 1973; Helbing, 1983). Data for 1975 and 1982 are from the Medicare Statistical System data for the present study.

major impact on the amount or distribution of program reimbursements. In fact, the average annual percent increases in per capita reimbursements between 1967 and 1982 for decedents and survivors were 14.5 percent and 14.3 percent, respectively. Any use of heroic measures to extend life does not appear to have resulted in extraordinary increases in the relative cost of treating dying persons as compared with persons who did not die.

Health care expenditures of the noninstitutionalized aged population can be compared to those of other noninstitutionalized persons through the National Medical Care Utilization and Expenditure Survey (Garfinkel, Riley, and Iannacchione, 1985). The survey contains information reported by respondents on annual charges for all health care services. Table 9 contains total charges for health care services for selected percentiles of persons 65 years of age or over and persons under 65 years of age. The data suggest that the population under 65 may have a slightly heavier concentration of charges among high-cost users than the population 65 years of age or over. For example, the top 5.0 percent of the aged accounted for 50.6 percent of charges, whereas the top 5.0 percent of the population under 65 years of age accounted for 57.9 percent of charges. Similarly, 1.0 percent of the aged group accounted for 21.2 percent of total charges, whereas 1.0 percent of the population under 65 years of age accounted for 28.5 percent of charges. These differences are not statistically significant, however, and the similarity of the distributions of charges for the groups over and under 65 years of age is shown graphically in Figure 2. Although the distribution of charges is similar between the population groups, the absolute charge levels are much higher for the aged. For example, the 95th percentile of charges is $7,131 for the aged, but for the population under 65 years of age the 95th percentile of charges is only $2,126.

Discussion

The extent to which Medicare expenditures are concentrated among a relatively few costly enrollees has remained quite stable over time for both Part A and Part B services. Reimbursements under both Parts A and B exhibited a slight lessening in concentration between 1975 and 1982. The costliest 2.7 percent of Part A enrollees accounted for 45.3 percent of Part A reimbursements in 1969, 45.6 percent in 1975, and 44.3 percent in 1982; for Part B the top 2.2 percent of beneficiaries accounted for 29.0 percent of reimbursements in 1969, 29.0 percent of inflation-adjusted reimbursements in 1975, and 28.5 percent of inflation-adjusted reimbursements in 1982. Although these differences are rather slight, it is important to remember that a slight shift in the distribution of Medicare expenditures can represent a large amount in dollars. We also found that the percent of enrollees receiving reimbursement for Medicare services in a year has increased. Thus, more enrollees are receiving program benefits than in the past.

Our findings suggest that the large and consistent increases in Medicare program expenses that have occurred during the last several years have not been driven only by the increasing costs of the heaviest users, but appear to represent increases in service use across the entire spectrum of enrollees. There is some indication that expenses attributable to decedents are increasing at approximately the same rate as those attributable to survivors, and any differences do not appear to have had a major effect on the distribution or level of program expenditures. This suggests that expensive methods of prolonging the lives of terminally ill patients are not the culprit behind increasing Medicare program costs. This finding

Table 9

Percent of medical care charges attributable to the heaviest users of services in the United States, by age: 1980

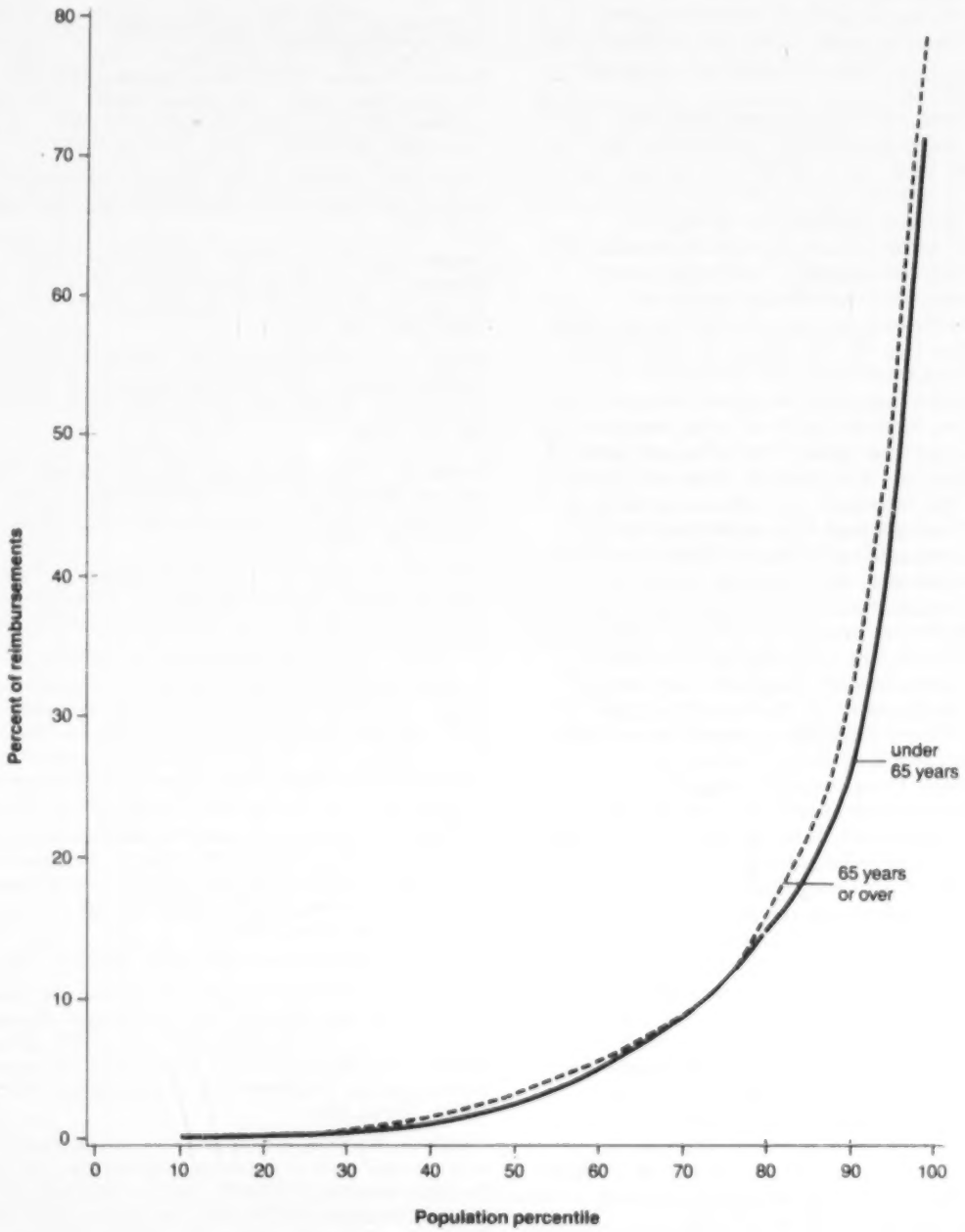
Enrollee percentile	Average per capita charge	Percent of charges	Standard error of percent of charges
65 years or over			
10.0	$4,001	68.4	2.50
5.0	7,131	50.6	3.47
1.0	16,701	21.2	4.07
Under 65 years			
10.0	1,012	73.3	0.95
5.0	2,126	57.9	1.48
1.0	6,833	28.5	2.24

NOTE: Data on the noninstitutionalized population only is included in this table.

SOURCE: (Garfinkel, Riley, and Iannacchione, 1985).

Figure 2

Cumulative percent of charges attributable to various percentiles of United States residents, by age: 1980



NOTE: Data on the noninstitutionalized population only is included in this figure.
SOURCE: Garfinkel, Riley, and Iannacchione, 1985.

supports the conclusions drawn by Scitovsky (1984), who reviewed existing research on the costs of care rendered to terminally ill patients. Drawing largely from studies of the Medicare population, she concluded that, "The high cost of medical care at the end of life is not a recent development . . . ", and that the data do not support the contention that, ". . . high medical expenses at the end of life are due largely to aggressive, intensive treatment of patients who are moribund."

There has been considerable speculation that sophisticated and expensive new technologies, such as CAT scans and total hip replacement, may have had a strong impact on the increase in Medicare expenditures and their distribution among aged enrollees. This speculation centers on the creation of a new class of high-cost enrollees. Although issues surrounding expensive technologies cannot be addressed directly with our data, this article provides indirect evidence that visible, expensive technologies have not profoundly changed the distribution of Medicare program expenditures among the aged. This finding is in line with the results of other research that indicates that high-cost patients are often not users of advanced technology. For example, Zook and Moore (1981) found that relatively few high-cost patients in their sample hospitals used high technology services. Schroeder, Showstack, and Roberts (1979) determined that it was the amount, more than the kinds, of services that distinguished high-cost patients from others. It is likely that many new medical technologies are of relatively low cost, and that low, moderate, and high-cost users have all benefited. New medical technologies, as measured by increases in intensity of services, have clearly produced a general upward shift in costs (Ruther, 1983; Office of Technology Assessment, 1984; Congressional Budget Office, 1979), but they have not altered the overall relative distribution of health care costs of the Medicare aged.

Evans (1983 a and b) has commented on the nature and inevitability of allocating limited health care resources. He has noted that research has indicated that much of the increase in health care costs attributable to the proliferation of health care technologies is not due to new, big, expensive procedures, but to the proliferation of new procedures that are not expensive individually. This article suggests that these new procedures are probably not concentrated among a small number of users, but rather are distributed among low-, moderate-, and high-cost users. This suggests that if attempts are made to ration new technologies, they will be difficult to implement in many instances because so many providers and patients would be affected.

Acknowledgments

The authors wish to express their appreciation to Marian Gornick and Allen Dobson of the Health Care Financing Administration for their helpful comments on earlier drafts of this article.

References

Andersen R., Lion, J., and Anderson, O.: *Two Decades of Health Services: Social Survey Trends in Use and Expenditure*. Cambridge, Mass. Ballinger Publishing Co., 1976.

Birnbaum, H.: *The Cost of Catastrophic Illness*. Lexington, Mass. Lexington Books, 1978.

Board of Trustees, Federal Supplementary Medical Insurance Trust Fund: *1983 Annual Report of the Board of Trustees of the Federal Supplementary Medical Insurance Trust Fund*. Washington, D.C., June 24, 1983.

Congressional Budget Office: *Controlling Rising Hospital Costs*. Washington, D.C., Congress of the United States, Sept. 1979.

Congressional Budget Office: *Catastrophic Medical Expenses: Patterns in the Non-Elderly, Non-Poor Population*. Washington, D.C., Congress of the United States, Dec. 1982.

Evans, R.: Health care technology and the inevitability of resource allocation and rationing decisions: I. *Journal of the American Medical Association* 249(15): 2047-2053, Apr. 15, 1983a.

Evans, R.: Health care technology and the inevitability of resource allocation and rationing decisions: II. *Journal of the American Medical Association* 249(16): 2208-2219, Apr. 22-29, 1983b.

Garfinkel, S., Riley, G., and Iannacchione, V.: High cost users of services. Draft report based on data from National Medical Care Utilization and Expenditure Survey, 1985.

Goldstein, I.: Personal communication, July 22, 1985.

Gornick, M., Beebe, J. and Prihoda, R.: Options for change under Medicare: Impact of a cap on catastrophic illness expense, *Health Care Financing Review*. Vol. 5, No. 1. HCFA Pub. No. 03154. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Fall 1983.

Helbing, C.: Medicare: Use and reimbursement for aged persons by survival status, 1979, *Health Care Financing Notes*. No. 1, HCFA Pub. No. 03166. Office of Research and Demonstrations, Health Care Financing Administration. Nov. 1983.

Kunkel, S.: Personal communication, March 5, 1984.

Lubitz, J. and Prihoda R.: The use and costs of Medicare services in the last 2 years of life, *Health Care Financing Review*. Vol. 5, No. 3. HCFA Pub. No. 03169. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Spring 1984.

McMillan, A., Pine, P., and Newton, M.: Medicare: Use of physicians' services under the supplementary medical insurance program, 1975-1978. *Health Care Financing Program Statistics*. HCFA Pub. No. 03151. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Mar. 1983.

Office of Research and Statistics, Social Security Administration: *Medicare: Health Insurance for the Aged, 1969, Section 1: Summary*. Washington, D.C. 1975.

Office of Technology Assessment: *Medical Technology and Costs of the Medicare Program*. OTA-H-227. U.S. Congress. Washington. U.S. Government Printing Office, July 1984.

Piro, P., and Lutins, T.: Utilization and reimbursements under Medicare for persons who died in 1967 and 1968. *Health Insurance Statistics, HI 51*. DHEW Pub. No.(SSA)74-11702. Office of Research and Statistics, Social Security Administration. Washington. U.S. Government Printing Office, Oct. 1973.

Ruther, M.: Medicare: Use of short-stay hospitals by aged and disabled inpatients, 1978. *Health Care Financing Program Statistics*, HCFA Pub. No. 03147. Office of Research and Demonstrations. Health Care Financing Administration. Washington. U.S. Government Printing Office, June 1983.

Schroeder, S., Showstack, J. and Roberts, H.: Frequency and clinical description of high-cost patients in 17 acute-care hospitals. *N Engl J Med* 300 (23): 1306-1309, June 7, 1979.

Scitovsky, A.: The high cost of dying: What do the data show?. *Milbank Memorial Fund Quarterly/Health and Society* 62(4):591-608, 1984.

Zook, C., and Moore, F.: High-cost users of medical care. *N Engl J Med* 302(18): 996-1002, May 1, 1980.

Zook, C., Moore, F. and Zeckhauser,R.: Catastrophic health insurance: A misguided prescription? *The Public Interest* (62): 66-81, Winter 1981.

Living arrangement choices of elderly singles: Effects of income and disability

by Christine E. Bishop

Logit regression is used to explain living arrangement choice of elderly single individuals. The propensity to live independently is found to increase with income and decrease with disability; an interaction effect for females suggests that income may lessen the impact of disability on the propensity to seek shared living arrangements. Independent living is less likely for people who are not white, foreign-born males, those with at least one adult child, and those in States with higher living costs; and more likely for the ever-married and those in States with high per capita nursing home use. If home care services are preferentially allocated to disabled elderly who live alone, resources may flow to higher income individuals who have been able to maintain independent households.

Introduction

The living arrangements of the disabled community-resident elderly can have a profound effect on their need for formal long-term care services. The well-documented (Kobrin, 1976; Michael et al., 1980; Pampel, 1983) trend of single Americans toward living alone thus takes on special significance for long-term care planning for the unmarried elderly. Nearby family members and friends assist many disabled older people who live alone (Shanas, 1979). However, by definition, elderly people living alone will be unable to rely on other household members should they need help because of a disabling condition. Without the availability of in-house assistance, the disabled person must turn to other sources of care, either formal or unpaid. In some situations, the presence of another person in the household is required for round-the-clock response to unpredictable needs. Thus, for the older person living alone, the onset of disability is more likely to necessitate a change of living arrangement, possibly institutionalization, or to result in unmet need.

The number of elderly Americans who live alone had grown to 7 million people by 1980, representing 27.7 percent of the population 65 years of age or over. Because they often outlive their spouses and are less likely to remarry, the proportion of older females living alone (5.6 million or 36.9 percent of females 65 years of age or over) is much greater than the proportion of older males (1.4 million or 14.1 percent of males 65 years of age or over). Yet the proportion of elderly persons living alone is similar for females and males when only the unmarried, noninstitutionalized population 65 years of age or over is considered: In 1980, 63.2 percent of the elderly community-resident unmarried females lived alone, as did 58.3 percent of the males (Table 1).

It is important to understand the effects of various factors on the trend toward living alone. During recent decades, females who might provide family support to older people have increasingly joined the paid labor force; divorce has disrupted many families; the longevity gap between females and males has not decreased, so that widows remain a high proportion of older females; and lower current fertility rates mean that tomorrow's elderly will have fewer adult children to whom they might turn for support. At the same time, the real income of older Americans has risen significantly, and with increasing longevity has come the possibility of a decrease in age-adjusted disability (Fries, 1980; Manton, 1982). These trends appear to have enabled many older people to choose an independent life style. Future shifts in all these factors may have important implications for the rate at which older people live alone and hence on the cost of long-term care.

The purpose of this article is to examine more closely the increasing propensity of unmarried older people to live independently rather than with relatives or friends. The general approach of the study is that of the economics of consumer choice, which assumes that individuals make decisions that maximize their well-being, subject to constraints on income and available alternatives for choice.[1] This approach allows identification of the factors that influence the decision to live independently, and it suggests how future levels of income, incidence of disability, and rates of fertility, marriage, divorce, and widowhood may be expected to affect the proportion of the elderly living independently.

Model of living arrangement choice

Consumer choice theory postulates that an individual making a decision between two discrete alternatives will implicitly evaluate his utility or well-being under each choice and choose the alternative

This project was supported by the Health Care Financing Administration, Grant No. 18-P-97038/1-05.

Reprint requests: Christine E. Bishop, Ph.D., Health Policy Center, Heller Graduate School, Brandeis University, Waltham, Massachusetts 02254.

[1]Two other studies have recently used similar approaches to model living arrangement decisions (Schwartz, Danzinger, and Smolensky, 1984; Wolf, 1984). Both make use of the Longitudinal Retirement History Survey, and thus deal only with the "young" elderly (60-71 years of age).

Table 1

Percent distribution of persons 65 years of age or over, by sex and type of living arrangement: Selected years 1965-80

Type of living arrangement	1965		1970		1975		1980	
	Female	Male	Female	Male	Female	Male	Female	Male
				Percent distribution				
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
With spouse	34.1	67.9	33.9	69.9	35.6	74.0	34.7	71.8
Institution or group quarters	4.7	3.8	5.0	4.5	5.6	4.4	7.0	4.0
Community resident not with spouse	61.2	28.3	61.2	25.6	58.8	21.5	58.4	24.2
Independent[2]	28.6 (46.7)	13.1 (46.3)	33.8 (55.2)	14.1 (55.1)	36.0 (61.1)	14.2 (65.8)	36.9 (63.2)	14.1 (58.3)
With others[2]	32.6 (53.3)	15.2 (53.7)	27.4 (44.7)	11.5 (44.9)	22.8 (38.8)	7.4 (34.2)	21.5 (36.8)	10.1 (41.7)

[1]Totals may not add to 100.0 because of rounding.
[2]Percent of total community residents not with spouse shown in parentheses.

SOURCE: U.S. Bureau of the Census: *1980 Census of Population*, Volume 1, Chapter D, Part 1, PC 80-1-D1-A. Washington: U.S. Government Printing Office, Mar. 1984.

providing the higher level of well-being. The probability that individuals will live independently *(P(I))* is thus equivalent to the probability that their utility of living independently (U_I) is greater than the utility of the best shared living arrangement (U_{SL}):

$$P(I) = P(U_I > U_{SL}).$$

This probability depends on two types of factors: first, differences between the alternatives that may make one preferable to the other; and second, preference of the individual decisionmaker with respect to these characteristics. Within this framework, a model of choice for living arrangement decision of the unmarried elderly must capture relevant aspects of individuals' alternatives as well as aspects of individual tastes and characteristics that may affect their evaluation of these alternatives.

The model assumes that individuals will be observed living alone or with others with a probability depending on their current characteristics, as if they continually sought the optimal living arrangement choice. In contrast to some other consumer decisions that are made daily or weekly, living arrangement has substantial inertia and is unlikely to be changed as rapidly as independent variables change. On the average, however, the model can be used to explain current living arrangements. Longitudinal studies are needed to study transitions in living arrangements that are presumably the result of changes in independent variables; however these studies must recognize the persistence of past choices, as indicated by models like the one considered here.[2]

The variables will be discussed in turn in the following sections.

Income

Income of the individual and of the best alternative household that might be joined does much to determine the relative attractiveness of the alternatives. In many cases, sharing a household allows an individual to save on living expenses and to consume more of other goods and services than would otherwise be possible, but at the expense of privacy and independence. Older people express strong preferences for maintaining independent households (Lopata, 1971; Schorr, 1980). It has been argued that independent living is what economists term a "normal good," in other words that more is purchased as income rises. When income is used as a variable in cross-sectional studies of individual behavior, it has been shown to have a positive effect on the propensity to live independently (Kobrin, 1981; Schwartz et al., 1984; Soldo and Lauriat, 1976; Wolf, 1984). Other analysts (Beresford and Rivlin, 1966; Michael et al., 1980; Pampel, 1983) have studied aggregate national and State data over time, and they conclude that rising real incomes of the elderly are responsible for at least some of the increase in the proportion of single individuals living alone. This analysis is confined to a one-time cross-section and tests the hypothesis that the single elderly with higher income are more likely to live alone.

Disability

A disabled person is expected to place a higher value on the presence of assisting household members, so that disability is hypothesized to increase the propensity to live with others. Disability measures have not been included in many available surveys, so this effect has not been widely studied. Schwartz et al. (1984), Soldo et al. (1981), and Wolf (1984) were able to include disability information in their models and to find some support for this hypothesis.

[2]The author and others, in work funded by the National Institute on Aging (AG04803), are using the National Housing Survey to examine active and passive living arrangement transitions of the elderly. Also, the National Long-Term Care Survey will provide a view of 2-year transition rates for elderly disabled persons.

Joint effects of disability and income

Informal in-house assistance becomes more valuable with greater disability. Yet individuals can alternatively spend their income on some needed services and still maintain independent living arrangements. Because disability may be seen as increasing the price of maintaining independence, it is hypothesized that the effects of disability and income are not additive; the purchase of privacy by people with higher incomes should respond less to disability than that by people with low incomes who face a similar "price increase" for independent living.

Adult children

The unmarried elderly who live with others often share households with their adult children. The strength of family ties, especially between mothers and daughters, has been well documented (Schorr, 1980). Bachrach (1980) found a nonlinear relationship between the number of living children and the probability that previously married older persons lived alone. She concluded that childlessness was a more important predictor of living alone and social isolation than was variation in the number of adult children. In terms of the current model, if individuals have adult children, their best shared-household alternative is likely to be with their own offspring, making the best shared-living alternative more attractive relative to living alone than it would be for a person with no adult children. The number of living adult children might also affect the attractiveness of the best shared-living alternative because the choice among households and the probability of daughters would increase.

Characteristics affecting tastes and alternatives

A number of attributes of older people have been associated with varying preferences for independent living (Belcher, 1967; Chevan and Korson, 1972; Lopata, 1971; Robinson and Thurnher, 1977; Troll, 1971; Schorr, 1980; Shanas and Sussman, 1981; and Oppenheimer, 1981). For example, females are found to maintain stronger family ties than males, implying that they are more likely to be comfortable in extended family living situations. The high prevalence of multigenerational households among persons who are not white and among the foreign-born has been explained by cultural factors supporting multigenerational living. Homemaking skills may also effect the relative attractiveness of living alone versus living with others. Individuals with few homemaking skills may have more to gain from living with others and may be more likely to choose a shared-living alternative. It is hypothesized that females and never-married males are more likely to live alone, other things constant, because of their greater experience in maintaining independent households. In this study, separate equations will be estimated for females and males. The effects of other personal characteristics will be evaluated holding income, disability, and other factors constant.

Environmental factors affecting living arrangements

Variations in the cost of living across regions may affect the relative attractiveness of shared versus independent living arrangements, other things being constant. The per person expenditure necessary to reach a given real standard of living is greater for a person who lives alone than it is for a person who shares a household with others, and this difference increases as the cost of living increases. Thus, other things being equal, it is expected that the consumer price level will have a negative effect on the propensity to live independently.

Elderly individuals making use of another alternative living arrangement, institutional care, are by definition omitted from any survey of community-resident elderly. The availability and use of nursing home care varies significantly across States, meaning that this living arrangement alternative is used by a varying proportion of State residents. In a State with few nursing home beds available, a given level of disability might cause individuals to live with others; but in a high-use State, they might instead be able to enter a nursing home, thus leaving the sample frame altogether. Alternatively, the rate of nursing home use could be the result of persistent regional patterns of family responsibility and shared-living arrangements, so that more beds are built in States where shared living is less common. Either explanation should result in a positive association between nursing home use and independent living, and both imply that this variable should not be omitted from the analysis. It is therefore hypothesized that the observed propensity to live independently rather than with others is greater in States with greater nursing home use.

It should be noted that characteristics affecting the probability of shared living are likely to affect the use of chronic institutional care as well. Cross-sectional studies of the observed living arrangements of the elderly should ideally cover the entire population, and include nursing home residence as a living arrangement alternative.[3]

To summarize, it is hypothesized that the probability of living independently is positively related to income and negatively related to disability, and that the effect of the interaction term is positive, reducing the negative impact of disability on the propensity of high income people to live independently. The foreign-born elderly and persons who are not white are hypothesized to be less likely to live alone, as are those who live where the cost of

[3]The authors and others, in a project previously cited, are using a combined sample of institutionalized and community-resident elderly to address this question.

living is high and those with adult children. Marital status is included in the model as a proxy for skills and experience for independent living, with the hypothesis that never-married individuals are more likely to live alone. Separate equations are estimated for males and females, because the effects of various characteristics (e.g. widowhood, income, adult children) on living arrangement are likely to differ by gender. Finally, per capita nursing home use is included to account for differences across States in the availability of this alternative living arrangement.

Data

Survey description

The Current Population Survey (CPS) subsample of the Survey of Low Income Aged and Disabled (SLIAD) includes information on the 1973 living arrangements, incomes, disabilities, and number of living children for 1,814 unmarried, noninstitutionalized individuals 65 years of age or over. A full description of the survey methods is given in Barron (1979). All residents in homes for the aged were excluded from the sample frame, along with those in other institutions. The sample frame for the unmarried includes only those individuals whose incomes for the year, July 1972 to June 1973, was less than $5,000. These indivduals comprised a substantial proportion of the Nation's nonmarried elderly.[4] It is important to note that the SLIAD was not limited to a particular age cohort of the elderly as the longitudinal surveys analyzed by others (Schwartz et al., 1984; Wolf, 1984) have been. During the survey, information was gathered about living children, in contrast to many surveys that include only adult children residing in the respondent's household. Although results from a limited sample should not be generalized to the entire unmarried population, findings are expected to apply to that segment of the population most likely to rely on Medicaid for long-term care, and results are expected to suggest directions for future analysis of more ideal data sets.

Variables

Means and standard deviations for the variables used in the study are presented in Table 2. The dependent variable, living independently (I), was set equal to 1 if the surveyed individual lived alone; I equals 0 if the individual lived with others. Information was available on nativity (FORBN = 1 if foreign-born), race (NONW = 1 if other than white), and income (Y)—the total of income from all sources for the respondent. The square of income (YSQ) was also included in the analysis to capture any decreasing marginal effects as income rises. The number of living children was treated as two variables: a dummy variable CHILD set equal to 1 if the respondent reported any living children, and continuous variable MORE indicating the number of living children above one. Marital status was represented by four dummy variables: widowed, divorced, separated, and an omitted case, never married. State per capita income (YPC73) serves as a proxy for State wage and price levels. A variable measuring State nursing home use, residents per 1,000 elderly (RESPC73), was included to reflect wide, persistent regional differences in availability and use of institutional care.

Nine responses about abilities to carry out everyday tasks that included grocery shopping, dressing, bathing, meal preparation, and leaving home were used to measure disabilities. The data were collapsed into two factor scores. The first factor score, labeled DISAB1, accounted for 48.0 pecent of the variation in these nine variables, and it was highly related to inability to carry out basic activities necessary for independent living. Those scoring high on this factor were unable to dress, bathe, and leave home. This factor also was correlated with the inability to do light housework and prepare one's own meals. The second factor, DISAB2, accounted for an additional 15.3

Table 2

Means and standard deviations for study variables for unmarried persons 65 years of age or over, by sex

Variable	Female	Male
Number of observations	1,421	393
I: living independently	.603	.606
	(.489)	(.489)
FORBN: foreign-born	.135	.183
	(.342)	(.387)
NONW: other than white	.122	.178
	(.328)	(.383)
Y: income	2,417.6	2,861.7
	(1,553.8)	(1,798.8)
CHILD: 1 or more living children	.754	.603
	(.431)	(.490)
MORE: number of children more than 1	1.60	1.43
	(2.11)	(2.19)
WIDOW: widowed	.829	.565
	(.377)	(.496)
DIVOR: divorced	.054	.132
	(.226)	(.339)
SEPAR: separated	.027	.102
	(.161)	(.303)
YPC73: State per capita income, 1973	4,954.0	4,997.8
	(624.0)	(606.6)
RESPC73: State nursing home residents per 1,000 elderly, 1973	55.76	54.52
	(16.98)	(16.51)
DISAB1: self-care factor	−.0182	.0584
	(.9665)	(.9121)
DISAB2: mobility factor	.1127	−.0707
	(.9084)	(.8554)
AGE	75.06	75.07
	(6.87)	(6.68)

NOTES: Data based on Survey of Low Income Aged and Disabled, Current Population Survey subsample. Income limit for sample was less than $5,000. Standard deviations are shown in parentheses.

[4]Of the Nation's unmarried individuals 65 years of age or over with incomes in 1973, 75.6 percent of males and 86.1 of the females had income less than the $5,000 SLIAD criterion (U. S. Bureau of the Census, 1976).

percent of the variation in the nine variables and reflected general mobility and strength. It was inversely related to ability to leave home without help and to grocery shop, and, to a lesser extent, to the ability to prepare meals and do heavy and light housework. In the presentation of results that follows, the disability factors are named "self-care" and "mobility." Variables measuring age and its square were also included to represent general frailty that might not be picked up by disability measures.

Results

Logit analysis (Amemiya, 1981) was used to estimate separate equations for 1,421 unmarried females and 393 unmarried males (Table 3); the coefficients for the females achieve a high level of significance. The equation for the smaller sample of males is not as convincing, but it provides interesting similarities and contrasts. The log likelihood chi-square test and the pseudo-R^2 (ρ^2 = 1 − ratio of the log likelihood of the model to the log likelihood of a model with constant term only) show a reasonable level of overall significance for the equations. The coefficients show the direction of effects of the independent variables on the probability of living independently; however, they must be evaluated at specific values to find the magnitude of the effects. This is because logistic regression analysis uses as a dependent variable the natural logarithm of the ratio of the odds of living independently:

$$ln \frac{P(I)}{1-P(I)} = \Sigma\, b_j\, x_{ij} + \epsilon_i$$

where $P(I)$ = probability of independent living

b_j = coefficients to be estimated

x_{ij} = independent variables

ϵ_i = error term

This means that the probability that individuals will live alone can be predicted by inserting their values for the independent variables and solving for $P(I)$, as in the following equation:

$$P(I) = \frac{e^{\Sigma b_j\, x_{ij}}}{1+e^{\Sigma b_j\, x_{ij}}}.$$

The effect of each independent variable on the probability of living alone is not easily derived from its estimated coefficients because its effect varies, depending on the base-line probability implied by the other independent variables. These effects are best understood by evaluating them for selected base cases, for example, for white, widowed females with mean income and disability.

Table 3

Logistic regression estimates for variables, by sex

Variable	Female	Male
Number of observations	1,421	393
Dependent variable: I = 1 if, living independently		
Constant	−8.352	−12.728
	(6.533)	(13.250)
FORBN: foreign-born	−.0614	*−.526
	(.182)	(.320)
NONW: other than white	***−.787	−.223
	(.195)	(.324)
Y: income	***.000351	.000278
	(.000100)	(.000170)
YSQ: income squared (0000)	*−.000167	−.000219
	(.00010)	(.000150)
CHILD: 1 or more living children	***−1.194	**−.807
	(.209)	(.356)
MORE: number of children more than 1	−.0385	−.0470
	(.0306)	(.0618)
WIDOW: widowed	***1.801	**.908
	(.267)	(.409)
DIVOR: divorced	***2.321	.203
	(.381)	(.451)
SEPAR: separated	***1.308	*.989
	(.436)	(.532)
AGE	.234	(.330)
	(.171)	(.344)
AGESQ: age squared	−.00150	−.00201
	(.00112)	(.901)
DISAB1: self-care factor	***−.583	−.175
	−(.167)	−(.321)
DISAB2: mobility factor	***−.555	***−.905
	(.141)	(.333)
YDIS1: Y × DISAB1	.000097	−.000101
	(.000080)	(.000150)
YDIS2: × DISAB2	*.000096	.000055
	(.000060)	(.000120)
RESPC73: State nursing home residents per 1,000 elderly, 1973	***.00957	−.0109
	(.00370)	(.0072)
YPC73: State per capita income, 1973	***−.000398	−.000022
	(.000110)	(.000210)
-2 log likelihood ratio (χ^2)	245.83	71.71
ρ^2	.128	.136

NOTES: Standard errors are in parentheses. Significance levels: * = 10 percent, ** = 5 percent, and *** = 1 percent.

Income

Income has a significant positive effect on independent living for females. The effect for males is also positive but smaller and significant only at the 10.3-percent level. The coefficient for the square of income shows that income has a decreasing effect on the propensity to live independently. Although base-case females (white; widowed; native born; with adult children, mean income for females, average disability

for females) were less likely to live with others than base-case males, the gap would be closed by an increase in their income to the mean level for males (Table 4). The females' decision to live alone is more responsive to income than the males': the elasticity of the propensity to live independently, computed at the base-case mean income and modal characteristics, is .227 for females and .144 for males.

Table 4

Predicted probability of independent living, by sex and income level

Income	Female	Male
$1,000	.542	.586
$2,000	.617	.634
$2,418[1]	.645	.651
$2,861[2]	.672	.671
$3,000	.680	.670
$4,000	.730	.695
$5,000	.770	.710

[1]Mean for females.
[2]Mean for males.

NOTE: Base case = white, widowed, mean age and children, native-born, disability factors at mean for each sex.

Disability

The disability factor scores, based on abilities to carry out various tasks, had a significant effect on independent living for females. As expected, the less disabled are more likely to live independently, other things being constant. The direction of the effect was similar for males, but it was only significant for the second disability factor, reflecting mobility.

Joint effects of income and disability

The positive signs for the interaction terms in the females' equation indicate that females used higher income to compensate for higher disability levels. The interaction between income and mobility is significant at the 10-percent level, and the coefficient for the interaction between income and self-care is greater than its standard error. The interaction terms for males are not statistically significant. Table 5 and Figure 1 show the predicted probabilities of living with others for females with various income and disability levels. The equation predicts that females

Figure 1

Effect of income and disability on the probability of independent living by women

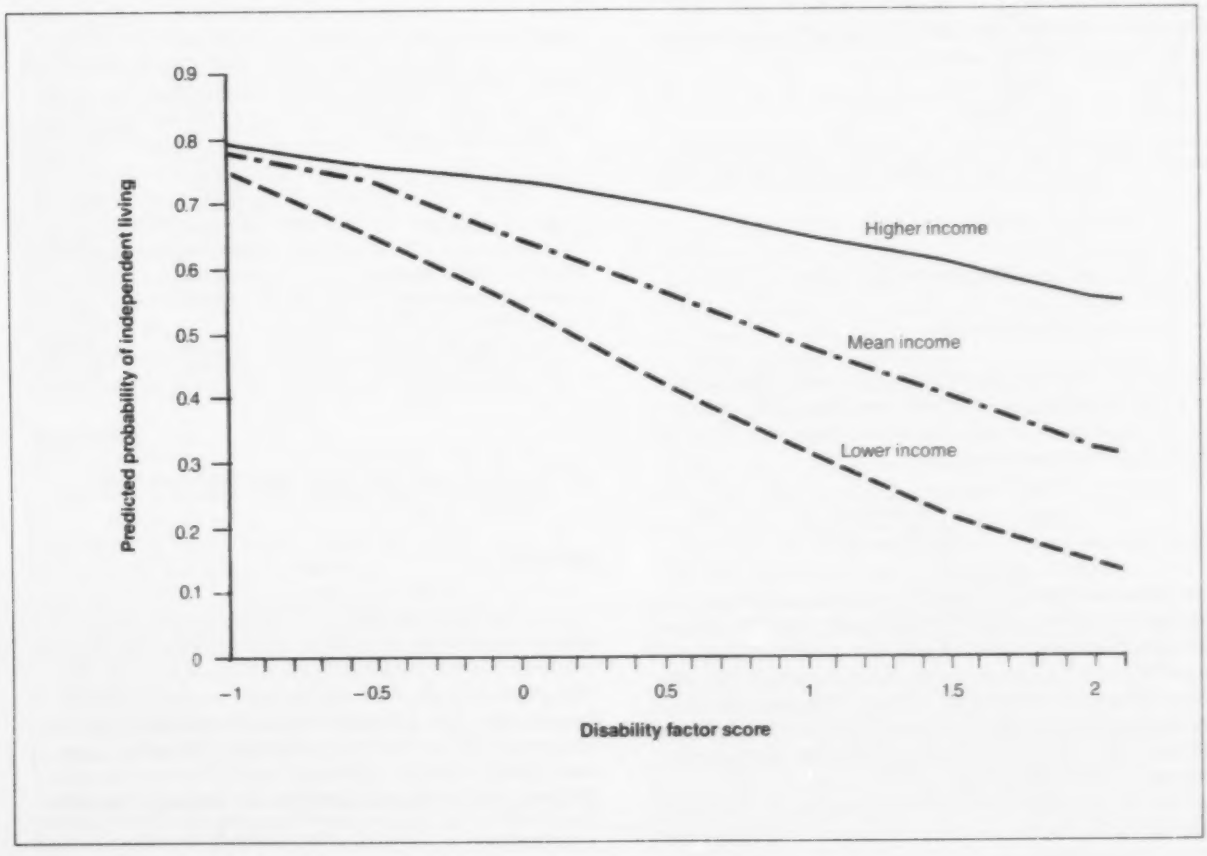


Table 5

Predicted probability of independent living for females 65 years of age or over, by income and disability

Income	Disability			
	Low	Average	Moderate	High
Low	.758	.530	.310	.145
Average	.786	.645	.489	.328
High	.799	.729	.655	.567

NOTE: Base case = white, widowed, native born, mean children.

with lower incomes and of all disability levels are more likely to live with others than are those with higher incomes and similar disabilities. This income effect is larger for the more disabled. Although increasing disability decreases the probability of living alone, disability causes smaller declines in the probability of independent living as income rises.

Adult children

Existence of at least one living child has a large and statistically significant effect on the propensity of unmarried elderly people to live independently, with a greater effect on females than on males. The existence of at least one adult child decreases the probability of living alone by about 31 percent for females and 17 percent for males, other things held constant. The existence of more adult children, indicated by the variable MORE, should open wider choice to the older person and increase the probability of having adult daughters, who are more likely to assist older parents. However, this variable had a small and insignificant effect.

Personal characteristics and alternatives

Females who are not white are significantly more likely to live with others even after accounting for their lower incomes. This cultural effect is so strong that females who are not white with incomes two standard deviations above the mean for all females are still more likely to live with others than white females are at the mean income level. This implies that the observed tendency of elderly persons who are not white to live with others is not because of their lower incomes alone; culturally determined preferences, or the needs of the sharing household for combined income or child care, are also important. This counters the conclusion of Soldo and Lauriat (1976) that race is not important to the propensity to live alone once income is accounted for. At the least, the current analysis indicates that race should be included in the analysis of living arrangement choice—in contrast to Kobrin (1981). Interestingly, foreign-born status had a significant negative effect on the propensity of males to live alone, but foreign-born females were not significantly less likely to live alone once income, disability, and other factors were accounted for. Unexpectedly, the never married of both sexes are less likely to live alone than widowed, divorced, and separated males and females are, holding constant existence of children and other factors. This may indicate development of long-term shared arrangements by this group. Alternatively, the ever married, with wider kin networks, may have developed better nonhousehold sources of assistance that allow them to maintain independence despite some disability.

Environmental factors

The State income variable had a significant negative coefficient. This variable, a proxy for State cost of living, shows the effect of prices for helping services and costs of living alone. Where prices are high, independent living is more difficult relative to shared-living arrangements.

Higher nursing home use in a State is associated with more independent living. This finding confirms a relationship between living arrangement choice and the demand for institutional care, implying that in States with higher nursing home use, all else constant, individuals are more likely to choose institutional care over shared living arrangements when they find it difficult to maintain an independent household.

Conclusions

The analysis has used a cross-sectional data base that accounts for own income, disability, existence of children, and other factors to examine the correlates of independent living. First, the results imply that independence in living arrangement is what economists term a normal good. Older individuals are more likely to choose independent living as income rises, other things, including race, sex, and disability, being constant. Disability and the existence of adult children were, as expected, associated with a greater probability of living with others. However, the number of adult children did not effect living arrangement. This finding is of special interest: Observers have been concerned that the elderly of the next century will have fewer sources of assistance because lower current lifetime fertility will yield fewer adult children. Yet projections (Federal Council on the Aging, 1981) indicate that fewer of these elderly will have no living adult children, because of increased longevity of their offspring and a higher proportion of females bearing at least one child. Thus, recent fertility trends, although reducing the number of adult children, could even increase shared-living arrangements, holding income and other factors constant.

Females were found to be more likely than males to live with others at the mean level of income for females. In the aggregate, this is consistent with the conclusions of previous researchers that females are more likely to choose shared-living arrangements than males are. However, the current analysis has shown that increasing income has a larger positive effect on

females' propensity to live alone than on males', so that males and females with average characteristics for their gender and mean income for males have nearly equal probabilities of living alone. Rising real income for all elderly people could lead to a higher rate of independent living for females than for males, all else being equal.

Females who are not white were found to be much more likely to live with others at any level of income and disability, indicating that income differences are not entirely responsible for observed racial differences in living arrangements. Foreign-born males were less likely of live alone, but the expected cultural differences in living arrangement choice did not appear for females once disability and income were accounted for.

The interaction effect found for females between income and the disability measure associated with mobility suggests that increased income may lessen the impact of disability on the propensity to seek shared-living arrangements. Little is known about private demand for paid disability-related services; this finding suggests that higher income may be used to compensate for disability, perhaps through the purchase of services that support an independent lifestyle.

This study may be compared with other recent multivariate cross-sectional studies of living arrangements (Bachrach, 1980; Kobrin, 1981; Tissue and McCoy, 1981; and Soldo et al., 1981.) Bachrach (1980) focused on the effect of childlessness on the probability of living alone, but she was not able to include income, and she found no significant health effect. Kobrin (1981) used ordinary least-square regression to explain living away from relatives for all unmarried individuals 25 years of age or over on the basis of income, age, sex, and marital status, but not on race or disability. Tissue and McCoy (1981) focused on short-term changes in living arrangement, using 1-year changes in income, disability, and other factors, so that their predictions may not be valid for long-run permanent income changes. Soldo et al. (1981) studied elderly white females only to explain household headship, a dependent variable with different policy implications from the living arrangement dependent variable used here.

Policy implications

If the real incomes of elderly people continue to rise, the analysis suggests that more individuals will choose to live independently, rather than with others, other things being constant. Paradoxically, this could lead to a decline in certain measures of well-being for the elderly, including household income and unmet need for personal health and social support services. As with other lower income groups, the undoubling of elderly households permitted by income gains may increase the number of households and persons living below poverty income levels.

Increasingly, public programs are attempting to target home care resources to disabled community-resident elderly who would otherwise be cared for in nursing homes. Researchers studying the probability of institutionalization for disabled elderly have identified living alone as an important factor increasing the use of nursing home care (Greenberg and Ginn, 1979; Branch and Jette, 1982; Capitman, 1985). The results presented here indicate that higher income, white, native-born elderly are more likely to live alone. It would indeed be paradoxical if public home care resources were differentially directed toward these relatively advantaged individuals.

If rising real incomes lead to increased independent living by the elderly, this may increase demand for institutional long-term care, other things being equal. Those whose income enables them to live alone may be more prone to seek institutional care when they become disabled, other things being constant, because in-home support is not in place for them. But higher income may instead defer the shared-living choice rather than omitting it from the living-arrangement continuum. This cannot be investigated using cross-sectional data restricted to the noninstitutionalized elderly. Longitudinal multivariate studies of the determinants of transitions from marriage and other living arrangements to either shared or independent living, and to institutionalization, could better define the changing roles of income, disability, and family support in these transitions and clarify their significance for future long-term care needs.

Acknowledgments

The assistance and advice of Margaret Stassen, William McMullen, Janet Giele, Saul Schwartz, William Cartwright, Barry Friedman, Lillian Henderson, and Mary Tess Crotty are gratefully acknowledged. I am also grateful to Thomas Tissue and John McCoy of the Social Security Administration for their assistance in acquiring and using this data set.

References

Amemiya, T.: Qualitative response models: A survey. *J Econ Literature* 19(4):1483-1536, 1981.

Bachrach, C. A.: Childlessness and social isolation among the elderly. *Journal of Marriage and the Family*, 42(3):627-637, 1980.

Barron, E.: Survey design, estimation, procedures, and sampling variability. *Survey of Low Income Aged and Disabled*. Report No. 5. HEW Pub. No. (SSA) 79-11723. Social Security Administration. Washington. U.S. Government Printing Office, 1979.

Beresford, J., and Rivlin, A.: Privacy, poverty and old age, *Demography*, 3(1):247-258, 1966.

Belcher, J. C.: The one-person household: A consequence of the isolated nuclear family? *Journal of Marriage and the Family*, 29:534-540, Aug. 1967.

Branch, L. G., and Jette, A. M.: A prospective study of long-term care institutionalization among the aged. *Am J Public Health* 72(12):1373-1379, Dec. 1982.

Capitman, J. A.: Determinants of Institutionalization Among Participants in a Nursing Home Pre-Admission Screening Program. Virginia Center on Aging, Medical College of Virginia, Virginia Commonwealth University, 1985.

Chevan, A., and Korson, J. H.: The widowed who live alone: An examination of social and demographic factors *Social Forces*, 51(1):45-53, Sept. 1972.

Federal Council on the Aging: *The Need for Long-Term Care*. DHHS Pub No. (OHDS) 81-20704. Office of Human Development Services, Department of Health and Human Services. Washington. U.S. Government Printing Office, 1981.

Fries, J. F.: Aging, natural death and the compression of morbidity. *N Engl J Med* 303(3):130-135, July 1980.

Greenberg, J., and Ginn, A.: A multivariate analysis of the predictors of long-term care placement. *Home Health Services Quarterly* 1(1):75-79, Spring 1979.

Kobrin, F. E.: Family extension and the elderly: Economic, demographic and family cycle factors. *J Gerontol* 36(3):370-377, 1981.

Kobrin, F. E.: The primary individual and the family: Changes in living arrangements in the United States since 1940. *Journal of Marriage and the Family* 38(2):233-239, 1976.

Lopata, H.: *Widowhood in an American City*. Cambridge. Schenkman, 1971.

Manton, K. G.: Changing concepts of morbidity and mortality in the elderly propulation. *Milbank Mem Fund Q* 60(2):183-244, Spring 1982.

Michael, R. T., Fuchs, V. R., and Scott, S. R.: Changes in the propensity to live alone: 1950-1976. *Demography*, (17)1:39-56, 1980.

Oppenheimer, V. K: The changing nature of life-cycle squeezes: Implications for the socioeconomic position of the elderly. *Aging: Stability and Change in the Family*. New York. Academic Press, 1981.

Pampel, F. C.: Changes in the propensity to live alone: Evidence from consecutive cross-sectional surveys, 1960-1976. *Demography* 20(4):433-447, 1983.

Robinson, B., and Thurnher, M.: Taking care of aged parents: A family cycle transition. *Gerontologist*, 19(6):586-593, 1977.

Schorr, A.: *"Thy Father and Thy Mother. . ." A Second Look at Filial Responsibility and Family Policy*. SSA Pub. No. 13-11953. Social Security Administration. Washington. U.S. Government Printing Office, 1980.

Schwartz, S., Danziger, S., and Smolensky, E.: The choice of living arrangement by the elderly. *Retirement and Economic Behavior*. Washington. Brookings Institution, 1984.

Siegel, S.: Demographic aspects of aging and the older population in the United States. *Current Population Reports*, Special Studies Series P-23, No. 59. U.S. Bureau of the Census. Washington. U.S. Government Printing Office, 1978.

Shanas, E.: The family as a social support system in old age. *Gerontologist* 19(2):169-174, 1979.

Shanas, E., and Sussman, M.: The family in later life: Social structure and social policy. *Aging: Stability and Change in the Family*. New York. Academic Press, 1981.

Soldo, B., and Lauriat, P.: Living arrangements among the elderly in the United States: A log linear approach. *Journal of Comparative Family Studies* 7(2):351-366, 1976.

Soldo, B. J., Sharma, M., and Campbell, R. T.: *The effects of functional health status and demographic characteristics on the living arrangements of older unmarried women*. Washington. Center for Population Research, Georgetown University, 1981.

Tissue, T., and McCoy, J. L.: Income and living arrangements among poor aged singles. *Soc Secur Bull.* 44(4) 3-13, Apr. 1981.

Troll, L. E.: The family of later life: A decade review. *Journal of Marriage and the Family* 33(2):263-290, May 1971.

U.S. Bureau of the Census: Money income in 1973 of families and persons in the United States. *Current Population Reports*. Series P-60, No. 97. Washington. U.S. Government Printing Office, 1976.

Wolf, D. A.: Kin availability and the living arrangements of older women. *Social Science Research* 13(1):72-89, 1984.

Cost and case-mix differences between hospital-based and freestanding nursing homes

by Margaret B. Sulvetta and John Holahan

Cost differences between freestanding and hospital-based skilled nursing facilities (SNF's) are identified and examined in this article. Although hospital-based and freestanding SNF's have significant differences in terms of location, admissions per bed, percent of Medicare days, occupancy rates, staffing, provisions of rehabilitative services, and patient characteristics, these are insufficient to fully explain cost differences. Less than one-half of the existing cost differences can be explained after controlling for case mix, staffing, and other cost-contributing factors. A reimbursement system that differentiates solely by provider type without relating rates to patient characteristics may overcompensate some providers and undercompensate others.

Introduction

The Medicare program covers short-term, post-hospital, and rehabilitative nursing home care. Most Medicare-certified skilled nursing facilities (SNF's) are freestanding, and they contain nearly 90 percent of all certified beds. These SNF's provide a less than proportionate share of Medicare patient days, representing 80 percent of all Medicare days, and a somewhat greater than proportionate share of total patient days.

Hospital-based facilities, on the other hand, comprise 14 percent of the total number of Medicare certified SNF's and contain 10 percent of all certified beds. However, these facilities provide nearly 20 percent of all Medicare days and roughly 10 percent of total patient days.

Although freestanding facilities provide the major share of Medicare days, Medicare accounts for only a small share of those facilities' total patient days (7 percent). Medicare is more important for hospital-based facilities where it accounts for 16 percent of total patient days.

Medicare reimbursement for SNF care is based on "reasonable cost," with routine operating costs subject to a ceiling. Other costs, such as capital and ancillary costs, are not subject to the ceiling and are simply "passed through", i.e., reimbursed at full cost. The setting of the routine operating cost ceiling has been the subject of considerable debate. In the past, much of the debate has centered on establishment of single versus dual limits for hospital-based and freestanding facilities. Dual limits set separate ceilings for freestanding and provider-based facilities and were designed to recognize the higher cost experience of hospital-based SNF's. Hospitals generally attribute their higher costs to both the methodology required by Medicare for the allocation of overhead costs and a more intensive case mix within the SNF setting. Under dual limits, 37 percent of hospital-based facilities had costs in excess of the ceiling, but under single limits based on average costs of freestanding facilities, 73 percent of all hospital-based SNF's exceeded reimbursement limits.

The current reimbursement system sets routine operating cost ceilings based on the cost experience of freestanding homes. The ceiling for freestanding homes is currently set at 112 percent of mean costs for freestanding facilities. The ceiling for provider-based SNF's is also set at 112 percent of mean costs for freestanding facilities, plus 50 percent of the difference between the mean costs of freestanding and hospital-based homes. Under the current system, about 62 percent of all hospital-based facilities incur nonreimbursable costs. The Health Care Financing Administration (HCFA) has acknowledged that the required method of allocating overhead costs to the SNF cost center may result in higher costs for hospital-based SNF's. In recognition of this, hospital-based homes are allowed an "add-on" to their ceiling. However, HCFA's Bureau of Eligibility, Reimbursement, and Coverage estimates that the average cost attributable to the overhead allocation procedures is minimal, amounting to $4.67 per patient per day for urban SNF's and $1.95 for rural SNF's, during the time period studied here.

This article addresses the issue of cost differences between hospital-based and freestanding Medicare certified skilled nursing facilities, and the question of how much of the cost difference should be recognized by the Medicare reimbursement system. It utilizes data on 3,492 of the 4,900 Medicare certified SNF's filing costs reports in 1980. These 1980 costs were projected to 1983 trending forward by the HCFA market basket. The projections adjust the cost reports to a common fiscal year, thus eliminating the problem of different cost-reporting periods. The sample facilities account for about seven-eighths of all Medicare patient days. Newly participating facilities, and those with small Medicare revenues, change of ownership, or decertification have been excluded.

Cost and facility characteristics

Medicare accounting procedures require skilled nursing facilities to report expenses on a cost-center

This report was funded by the Health Care Financing Administration (Grant No. 18-P-98274).

Reprint requests: Margaret B. Sulvetta, Health Policy Center, The Urban Institute, 2100 M Street, NW., Washington, D.C. 20037.

basis. Separate cost centers exist for routine inpatient services, ancillary service departments, overhead (e.g., administration, maintenance, laundry, dietary, housekeeping), and capital costs. It is therefore possible, using Medicare cost report data, to examine cost differences between freestanding and hospital-based facilities on a cost-center basis.

Average costs by facility type and major cost category are shown in Table 1. Unweighted total average costs of hospital-based facilities are 72 percent higher than those reported by freestanding SNF's. Average costs weighted by Medicare patient days are higher than unweighted cost, reflecting the fact that the facilities providing Medicare services are generally among the higher cost SNF's. As previously noted, 16 percent of all patient days provided by hospital-based facilities are Medicare days, compared with only 7 percent among freestanding homes.

Because Medicare reimbursement limits are based on Medicare patient days, the mean costs utilizing that weight are most relevant. Total average costs among hospital-based facilities (weighted by Medicare days) are twice those of freestanding homes. Hospital-based facilities reported higher costs across all cost categories. Among the nonpatient-related categories, routine overhead costs were about 104 percent higher and capital costs were 52 percent higher. Among the patient-related categories of routine nursing and ancillary costs, costs of provider-based facilities ranged from 25 percent higher for drugs and supplies to 186 percent higher for therapy costs. The significantly higher costs for therapy services may partially reflect the fact that hospitals are more likely to have therapists on staff than are freestanding facilities. Freestanding facilities frequently contract out for rehabilitation therapies and such services are billed and reimbursed under Medicare Part B (supplementary medical insurance). Thus, therapy costs may have a greater probability of being included in the cost reports from hospital-based SNF's than in the cost reports from freestanding facilities.

Given the existence and magnitude of the cost differences across facility types, the issue then becomes one of identifying potentially contributing factors. It is possible that hospital-based and freestanding facilities are intrinsically different in their characteristics and that such differences explain the divergent cost patterns. Possible explanatory factors include underlying differences in the geographic distribution of facilities, compensation levels, ownership type, staffing or service provision (proxy measures of quality of care), case mix, or inefficiency.

A wide divergence does exist in the location of hospital-based and freestanding facilities in terms of community size. Nearly 79 percent of all freestanding homes are located in urban areas, whereas hospital-based SNF's are fairly evenly split between urban and rural locations. Given the greater expenses frequently associated with urban locations (e.g., higher wage rates, capital costs, etc.), the predominantly urban makeup of freestanding facilities makes their previously noted lower costs even more striking.

Significant differences also exist across facility type with regard to type of ownership. Three-quarters of all freestanding facilities have proprietary ownerships, yet less than one-tenth of all hospital-based facilities are proprietary. Hospital-based facilities are primarily nonprofit (58 percent) and government owned (34 percent). Approximately 20 percent of all freestanding SNF's are nonprofit. In terms of patient days, nonprofit facilities account for about 63 percent of all hospital-based SNF Medicare patient days; proprietary facilities provide 77 percent of all freestanding SNF Medicare patient days.

Weighted average SNF costs for 1983 by facility type, community size, and ownership type are presented in Table 2. The costs of hospital-based facilities exceed the costs of freestanding homes regardless of location. Within urban areas, total average costs for freestanding facilities are estimated to have been $68.86 in fiscal year 1983, compared with $141.61 for hospital-based facilities, a difference of 106 percent. Within rural areas, average costs for freestanding facilities totaled $57.04, compared with $96.39 for hospital-based facilities, a difference of 69 percent. A similar pattern is evident within the routine operating cost category. Although basic differences do exist across facility types with regard to urban versus rural setting, these differences do not explain the cost differential.

Table 1

Average facility costs by type of facility and cost category: 1983

Cost category	Unweighted mean		Weighted by Medicare days		Weighted by total days	
	Freestanding facility	Hospital-based facility	Freestanding facility	Hospital-based facility	Freestanding facility	Hospital-based facility
	Amount in dollars					
Total Costs	$61.12	$105.31	$66.95	$131.51	$61.80	$97.76
Routine operating	45.76	77.88	48.37	94.98	47.51	74.49
Routine nursing	18.77	29.86	19.86	36.85	19.03	27.74
Routine overhead	26.99	48.01	28.50	58.14	28.48	46.75
Medicare ancillary	11.39	22.32	14.12	29.75	11.33	19.19
Drugs and supplies	5.26	8.37	6.58	8.18	4.62	6.53
Therapy	6.13	13.95	7.54	21.57	5.71	12.64
Capital costs	3.98	5.11	4.46	6.78	3.96	4.10

SOURCE: The Urban Institute: Skilled Nursing Facility Study, 1980 Cost Report data projected to 1983.

It is also evident from Table 2 that differences in ownership type do not explain cost differences. Once again, costs of hospital-based homes exceed those of their freestanding counterparts across all ownership categories. The greatest disparity is found among proprietary homes with hospital-based SNF total costs exceeding those of freestanding facilities by 125 percent. Nonprofit and government operated hospital-based SNF's have estimated costs that exceed those of freestanding facilities by 83 percent and 43 percent, respectively.

Regression analysis of cost differences

In addition to cost and facility characteristics, other factors such as State policy, case mix, occupancy rates, admissions per bed, and percent of Medicare days may influence the level of average facility costs.

State policy is important in explaining average facility cost because Medicaid is the largest public payer for nursing home care. Estimated Medicaid expenditures for elderly individuals in 1984 amounted to $4.45 billion. By contrast, Medicare expenditures for the same period amounted to $348 million (Waldo and Lazenby, 1984). Because Medicaid SNF coverage and reimbursement practices vary by State, nursing home costs are influenced heavily by State policy variables. If hospital-based facilities tend to be located in States with weak reimbursement controls, and therefore have higher average costs, some of the difference in costs between the two types of facilities may be explained by location.

The geographic distribution of hospital-based and freestanding facilities is different. About 63 percent of all freestanding facilities are located in the relatively generous Medicaid States (with regard to expenditures per capita) such as California, New York, Pennsylvania, Ohio, and Michigan, compared with 42 percent of all hospital-based facilities.

One of the major causes of cost differences across facility types cited by hospital administrators is that hospital-based facilities treat a different, more intensive case mix. Case mix generally refers to the distribution of patients within a facility according to the characteristics that reflect the type and quantity of care required (Cameron and Knauf, 1982). Facilities with a high percent of Medicare days are generally oriented toward the short-term rehabilitation patient. In this sense, percent of Medicare days can be considered a crude measure of case mix. Higher cost facilities tend to have greater percents of Medicare days than lower cost facilities. Hospital-based facilities have an average 16 percent of total days attributable to Medicare, compared with only 7 percent among freestanding facilities.

Another proxy case-mix measure is admissions per bed. In general, the greater the number of admissions per bed, the greater the tendency toward the more expensive short-term rehabilitation patient. About 21 percent of all hospital-based homes have a high number of admissions per bed (six or more admissions per bed per year), compared with 13 percent of all freestanding homes. Facility occupancy rate is an additional factor contributing to total cost. Lower occupancy rates are associated with higher costs because the facility is incurring costs for unused beds. The average occupancy rate for freestanding facilities is 93 percent, compared with an average rate of 86 percent for hospital-based facilities.

In this section, we present the results of a regression equation that controls for these and other factors and provides estimates of the remaining cost differences between hospital-based and freestanding facilities. The model explains a substantial portion of both total costs and routine operating costs. A listing of regression variables is presented in Table 3, and the results of the regression analysis of total costs and routine operating costs are presented in Table 4.

The most interesting finding is that compared with freestanding facilities, hospital-based SNF's are positively and significantly related to total and routine operating costs. After controlling for all other variables, hospital-based facilities have total average costs that exceed those in freestanding facilities by $27.62 per day. Routine operating costs in hospital-based facilities exceed those in freestanding SNF's by $17.46 per day after controlling for all other variables. Thus, even after the influence of the facility characteristics described earlier have been taken into account, hospital-based facilities have remaining

Table 2

Average skilled nursing facility costs weighted by Medicare days, by type of community and ownership: 1983

Type of community and ownership	Total costs		Routine operating costs	
	Freestanding	Hospital-based	Freestanding	Hospital-based
	Amount in dollars			
Community				
Urban	$68.86	$141.61	$49.44	$102.11
Rural	57.04	96.39	42.79	70.23
Ownership				
Proprietary	64.66	145.47	45.50	99.99
Nonprofit	74.75	136.94	56.61	98.15
Government	75.11	107.12	64.43	82.84

SOURCE: The Urban Institute: Skilled Nursing Facility Study, 1980 Medicare Cost Report data projected to 1983.

Table 3

Regression analysis variables

Variable	Definition	Mean	Standard deviation
RURAL	Binary variable indicating rural area.	0.25	0.43
PROP	Binary variable indicating proprietary facility.	0.67	0.47
NP	Binary variable indicating nonprofit facility.	0.24	0.43
WAGE	Hospital wage index.	1.08	0.17
BEDS	Number of certified beds.	79.45	70.22
PMEDCERT	Percent of Medicare days.	0.13	0.19
APB	Admissions per bed.	2.90	4.09
OCC80	Occupancy rate in certified beds.	0.92	0.11
DP	Binary variable indicating freestanding distinct part facility.	0.48	0.50
HB	Binary variable indicating hospital-based facility.	0.14	0.34
CH	Binary variable indicating chain facility (10 or more facilities under the same ownership).	0.17	0.34

Table 4

Regression analysis coefficients

Independent variables	Dependent variable: Total costs	Dependent variable: Routine operating costs
R^2	.64	.67
RURAL	*-2.26	-.45
	(-2.41)	(-.70)
PROP	*-13.10	*-15.80
	(-10.23)	(17.97)
NP	*-3.72	*-5.95
	(-2.97)	(-6.91)
WAGE	*35.30	*31.30
	(10.94)	(14.31)
BEDS	.01	*.01
	(1.70)	(2.97)
PMEDCERT	*55.47	*36.13
	(23.82)	(22.61)
APB	*.34	*.25
	(3.51)	(3.78)
OCC80	-60.69	*-44.46
	(-17.60)	(-18.78)
DP	1.05	1.07
	(1.30)	(1.93)
HB	*27.62	*17.46
	(21.62)	(19.91)
CH	-1.51	*-2.09
	(-1.71)	(-3.44)

*Significant at the .01 level.
NOTES: See Table 3 for definitions of variables. *T*-statistics are given in parentheses.

unexplained higher costs than their freestanding counterparts.

With regard to the other independent variables, we find that rural location is a negative and significant factor with regard to total costs, but not with regard to routine operating costs (ROC). Relative to government homes, proprietary facilities are found to have total costs that are $13.10 less per day and routine operating costs that are $15.80 less per day. Nonprofit homes are significantly lower than government homes in total costs (by $3.72) and routine operating costs (by $5.95).

The wage index, which is a measure of wage costs in an area, is a significant, positive variable for both total costs and routine operating costs. The number of certified beds is a slightly positive but significant variable for both total and routine operating costs. Percent of Medicare days and admissions per bed—the two proxy case-mix variables—are each positive and significant for total and routine operating costs. The percent of Medicare days variable, in particular, is a strong predictor of both total and operating costs. That is, both measures of costs increase as the percent of Medicare days increases.

In a separate regression, not shown, the percent of Medicare days variable was restructured as a set of four binary variables. The results showed that total costs per day increased from an average of $2.91 for facilities with 5.0 to 9.9 percent of Medicare days, to $5.44 for facilities with 10.0 to 19.9 percent of Medicare days, $6.75 for facilities with 20 to 39.9 percent of Medicare days, and $26.08 for facilities with more than 40 percent of Medicare days.

Occupancy rate is a negative and highly significant variable. Distinct part certification[1] is a positive and significant variable for both total cost and ROC, whereas the chain facility variable is negative and significant.

Many of the State coefficients were significant. Compared with California, eight States (Hawaii, Maine, Mississippi, Minnesota, Nebraska, New York, Utah, and Vermont) have relatively high costs. Again compared with California, 14 States (Alabama, Colorado, Florida, Georgia, Idaho, Illinois, Kansas, Kentucky, Michigan, Montana, North Dakota, Ohio, Oregon, and Texas) have relatively low costs, other things equal. To the extent that hospital-based facilities are disproportionately located in relatively high-costs States and freestanding SNF's are located in relatively low-cost States, part of the differences in total and routine operating costs may be explained by location.[2]

Case-mix variation

The measures of case-mix differences used in the analysis up to this point must be considered crude proxies and are not intended to provide a definitive answer with regard to the issue of case-mix variation across facility types. In this section, we examine a more direct measure of case mix in a sample of 1,584 hospital-based and freestanding nursing homes from 30 States.

[1]A "distinct part" is a separate unit within a larger institution that is certified as a skilled nursing facility.
[2]Complete results on the State variables may be obtained from the authors.

Patient characteristics and resource use

The relevance of case mix to facility cost lies in the relationship of patient characteristics to level of resource use. If a facility has a high percent of patients whose characteristics are associated with intensive resource use, that facility may legitimately incur higher costs than a similar facility with relatively lower resource use patients. The most relevant measure of patient case mix then, is one which relates specified patient characteristics to resource usage, such as nursing time. Several studies have addressed this relationship and offered patient classification schemes (Stassen and Bishop, 1983; Shaugnessy et al., 1982; Fries and Cooney, 1984). One problem confronting many of these researchers is the lack of available relevant data. For this reason, many studies have been confined to analysis of facilities within single States and have therefore been based on small sample sizes. This section makes use of data collected by the Medicare and Medicaid Automated Certification System (MMACS) in 30 States. The variables provide a measure of the number and percent of total patients within an individual facility by specific patient characteristics. The MMAC survey questions pertained to all SNF patients, not just Medicare patients. Although the variables included here are not ideal measures of case mix, they can be considered more direct indicators than the proxy variables of percent of Medicare days and admissions per bed, and they do include 1,373 freestanding and 211 hospital-based facilities.

The major shortcoming of these data is that, as currently structured, they do not directly relate patient characteristics to resource use. Thus, for example it is not possible to state whether facilities with a higher percent of patients with characteristic A and a lower percent with characteristic B have a less/more intense case-mix than facilities with the reverse pattern. In addition, the facilities percent of patients with specified characteristics does not provide a complete picture of the severity of the overall case-mix largely because it does not identify the percent of patients with multiple dependencies of characteristics. It is useful, however, to identify the differences by facility type in the relative percents of patients by each individual patient characteristic. If, for example, hospital-based SNF's were found to have higher percents of patients in every category indicating greater levels of resource use, it would be clear that those homes had a more intense case-mix. However, differences in some, but not all, characteristics will contribute to more tenuous conclusions.

Data on the percent of total patients by patient characteristics and facility type are presented in Table 5. Although data on the characteristics of Medicare patients are not available, using information on all patients is consistent with the data available on costs, staffing, etc. That is, Medicare pays on the basis of average costs for the facility, staffing ratios are relative to total beds, etc. One exception is ancillary costs where data used in this article relate specifically to Medicare patients.

Table 5

Percent of total patients, by type of facility and patient characteristics

Patient characteristic	Unweighted means	
	Freestanding	Hospital-based
Completely bedfast patients	.043	**.087
Patients requiring no assistance with ambulation	**.162	.138
Patients requiring assistance with ambulation	.514	.543
Patients requiring full assistance in eating	.231	.258
Patients requiring some assistance in eating	.257	**.309
Patients with indwelling catheters	.148	**.209
Incontinent patients	*.463	.431
Patients with decubiti	.082	.094
Patients with bowel and bladder retraining	.081	**.145
Patients receiving special skin care	.331	**.396
Confused or disoriented patients	**.556	.495
Patients receiving intravenous or blood transfusions	.003	**.014
Bed-to-chair patients	.374	.356

*Statistically significant at the .05 level.
**Statistically significant at the .01 level.

What emerges is a somewhat mixed picture. Hospital-based facilities are found to report a higher percent of persons requiring assistance in eating and ambulation but a lower percent of confused, disoriented or incontinent patients. With the exception of the confused and incontinent patients, hospital-based facilities tend to have a higher percent of patients than freestanding homes in every category indicating resource use.

We can also group the patient characteristics variables in an effort to more closely relate a given set of characteristics to a given level of required resources. Three groups can be developed to measure the level of dependency in the patient population: the percent of patients with functional dependency, the percent of patients requiring special nursing procedures, and the percent requiring extra staff time.[3] An approximate measure of level of dependency would include the percent of patients who: are completely bedfast, require assistance in ambulation, or require full assistance in eating. The percent of patients requiring special nursing procedures could be measured by the percent of patients with indwelling catheters, requiring special skin care, or patients with

[3]The Health Care Financing Administration is currently studying these patient characteristic groupings, which were specified according to the findings of the New York Department of Health's study of resource utilization groups.

Table 6

Number of facilities and percent of total patients, by percent of Medicare days, type of facility, and patient characteristics

Patient characteristic	Percent of Medicare days							
	Less Than 10		10 to 34.99		35 to 64.99		65 or more	
	Free-standing	Hospital-based	Free-standing	Hospital-based	Free-standing	Hospital-based	Free-standing	Hospital-based
	Unweighted percents							
Number of facilities	937	120	311	45	88	16	32	30
Completely bedfast patients	.036	**.070	.060	**.118	.053	*.124	.054	.085
Patients requiring no assistance with ambulation	.169	.174	**.146	.105	**.157	.088	.149	.078
Patients requiring assistance with ambulation	.507	*.561	.512	.458	.575	.531	.549	.609
Patients requiring full assistance in eating	.225	.237	.254	**.330	.226	.296	.213	.213
Patients requiring some assistance in eating	.255	**.317	.258	.276	.248	.291	.302	.332
Patients with indwelling catheters	.122	.149	.202	**.293	.209	*.309	.215	.266
Incontinent patients	.466	.443	.464	.477	.447	.421	*.425	.322
Patients with decubiti	.069	.061	**.112	**.157	.112	.139	.111	.113
Patients with bowel/bladder retraining	.078	**.168	.089	.091	.093	.111	.066	*.153
Patients receiving special skin care	.321	.356	.347	.420	.372	.493	.336	.472
Confused or disoriented patients	**.553	.493	.568	.541	.558	.506	.513	.431
Patients receiving IV or blood transfusions	.003	.003	.005	.023	.004	*.046	.003	**.029
Bed-to-chair patients	**.376	.298	.379	**.493	.325	.361	.390	.378

*Statistically significant at the .05 level.
**Statistically significant at the .01 level.

intravenous tubes or receiving blood transfusions. The percent of patients requiring extra staff time would be measured by the percent of patients who are incontinent, with decubiti, or confused or disoriented.

Utilizing these groupings, we find that hospital-based homes have a higher percent of patients with functional dependency and requiring special nursing procedures, but a lower percent of patients requiring extra staff time.

If the percent of patients receiving blood transfusions or with intravenous tubes provides a crude indicator of the level of medical problems, and the percent of confused or disoriented patients a measure of the intensity of psychosocial problems, then hospital-based SNF's have a more severely medically impaired patient population, and freestanding homes have a more severely mentally impaired population. The difference in the means of both variables is statistically significant.[4]

We examine the relationship between provision of Medicare services and a facility's patients characteristics in Table 6. Facilities are classified by the percent of Medicare days to examine the impact on patient characteristics. There are two findings of interest. First, the difference between freestanding and hospital-based facilities is greatest for homes with less than 35 percent of their patients covered by Medicare. There are few significant differences in the facilities with a high percent of Medicare patients. Second, the relationship between the percent of Medicare days and the various patient characteristics measures seems weak. In most instances, the percent of patients with different impairments does not increase with the percent of Medicare days in the facility. This could reflect the possibility that the percent of patients with specific impairments may be measured with some error. The percent of Medicare days may also better capture the number of patients with multiple impairments.

Because these data provided additional information on case mix, we merged them with cost report data and estimated additional regressions including each patient characteristic variable. Several variables are significant. The percent of patients who are completely bedfast, the percent requiring some assistance in eating, the percent with indwelling catheters, and the percent requiring special skin care add significantly to total costs. The percent needing no assistance with ambulation and the percent who are incontinent were negatively related to total costs. However, after controlling for these patient

[4]Shaughnessy et al. (1985) found that hospital-based Medicare patients were less likely than Medicare patients in freestanding facilities to require the traditional maintenance services provided by nurses and more likely to require skilled nursing and therapist services.

characteristic measures, differences between hospital-based and freestanding facilities still remain large—$26.11 for total costs and $18.51 for routine operating costs.[5]

Staffing differences

Staffing pattern differences between facilities may reflect inefficiencies in the use of resources, different case mixes, or differences in the "quality" of care provided. All of these latter factors may involve a greater or lesser use of resources per fixed unit of output (McKnight, 1970).

One such measure of resources per fixed unit of output is the number of nursing hours per inpatient day. Hospital-based facilities average 3.9 hours of nursing care, compared with 3.27 hours provided in freestanding homes.

The difference in nursing hours in hospital-based versus freestanding facilities is much more pronounced in urban than in rural areas. Hospital-based facilities in urban areas provide 4.15 nursing hours per inpatient day whereas urban freestanding facilities provide 3.43 hours. In contrast, rural hospital-based SNF's provide only slightly more hours per inpatient day than rural freestanding SNF's with 3.65 and 3.22 hours, respectively.

Differences in staffing patterns may also be measured by the number of rehabilitation therapies offered (physical, occupational, and speech therapy) and by the number of nurses per bed. The distribution of facilities characterized by combining these measures of staffing patterns is presented in Table 7. Nurse-to-bed ratios have been defined in the following manner:

- High—one nurse to nine or less beds.
- Moderate—one nurse to 10-13 beds.
- Low—one nurse to 14 or more beds.

Facilities are cross-classified as providing none, one, or two or more rehabilitation services.

Hospital-based facilities are greater providers of rehabilitation services than freestanding facilities. Nearly 35 percent of all hospital-based homes provide two or more rehabilitation services, compared with only 15.1 percent of freestanding homes. In addition, approximately 92 percent of all hospital-based facilities have high nurse-to-bed ratios, but only 59 percent of all freestanding SNF's fall into that category.

The difference across urban and rural locations is striking. For urban hospital-based facilities, about 30 percent provide no rehabilitation services and about 51 percent provide two or more. For rural hospital-based homes, nearly 55 percent provide no rehabilitation services and only 19 percent provide two or more. A similar, though less dramatic, pattern can be observed among freestanding homes. For urban facilities, 60 percent provide no rehabilitation services and 17.2 percent provide two or more. For rural freestanding homes, about 68 percent provide no rehabilitation services and 7.6 percent provide two or more.

Staffing differences between hospital-based and freestanding facilities may be attributable to differences in all of the factors discussed earlier: location, State policies, percent of Medicare days, admissions per bed, and patient characteristics. To control for these variables we estimated a regression with registered nurses (RN's) and licensed practical nurses (LPN's) per bed as the dependent variable and the same set of explanatory variables as in the previous cost regressions. The dummy variable for hospital-based SNF's was again highly significant with the results suggesting that hospital-based facilities employ seven nurses more per hundred beds than freestanding facilities, after patient mix, State, percent of Medicare days, and other variables are held constant.

As shown in Table 8, even when staffing pattern differences are taken into account, hospital-based facilities costs exceed those of freestanding homes. When we control for nursing ratios and rehabilitation services provision, hospital-based costs still exceed freestanding costs. The excess exists at every staffing level and ranges from 12 percent for urban facilities with one rehabilitation service and low nurse-to-bed ratios ($47.02 for freestanding, $52.51 for hospital-based) to 183 percent for rural facilities with two or more rehabilitation services and moderate nurse-to-bed ratios ($41.42 for freestanding, $117.19 for hospital-based).[6]

These higher costs cannot be explained by the composition of the nursing staff within facility types. In fact, freestanding facilities have a higher percent of registered nurses to total nursing staff than hospital-based facilities. Among the freestanding SNF's, an average 51 percent of all nurses are RN's, compared with 46 precent in hospital-based homes.

These cost differences could be attributable to other differences between hospital-based and freestanding homes. To test whether cost differences remained after staffing patterns are controlled, we added the RN's- and LPN's-per-bed variable to the cost regressions. The results showed that although staffing is clearly related to costs, substantial differences between hospital-based and freestanding homes remain. The estimated difference is $16.31 for routine operating costs and $23.03 for total costs. This implies that cost differences cannot be fully explained by the case-mix and staffing variables we have employed.

[5]These estimates were made using a subset of facilities which had data on patient characteristics. The numbers should not be directly compared with the differences in hospital-based and freestanding facility costs cited earlier.

[6]Rehabilitation services are an ancillary cost rather than a routine operating cost. They are, thus, included here as a proxy measure for quality of care rather than as a cost-contributing factor.

Table 7

Percent distribution of skilled nursing facilities, by location, type of facility, number of rehabilitation therapies, and nurse-to-bed ratios

Number of rehabilitation therapies and nurse-to-bed ratios	All locations				Urban				Rural			
	Freestanding		Hospital-based		Freestanding		Hospital-based		Freestanding		Hospital-based	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All facilities	2,932	100.0	464	100.0	2,314	100.0	231	100.0	618	100.0	233	100.0
High nurse-to-bed ratio	1,726	58.9	426	91.8	1,338	57.8	211	91.3	388	62.8	215	92.3
Moderate nurse-to-bed ratio	651	22.2	27	5.8	519	22.4	13	5.6	132	21.3	14	6.0
Low nurse-to-bed ratio	555	18.9	11	2.4	457	19.7	7	3.0	98	15.9	4	1.7
No rehabilitation	1,794	61.2	196	42.2	1,372	59.3	69	29.9	422	68.3	127	54.5
High nurse-to-bed ratio	998	55.6	180	91.8	748	54.5	62	89.8	250	59.2	118	92.9
Moderate nurse-to-bed ratio	445	24.8	10	5.1	344	25.1	4	5.8	101	23.9	6	4.7
Low nurse-to-bed ratio	351	19.6	6	3.1	280	20.4	3	4.3	71	16.8	3	2.4
One rehabilitation therapy	694	23.7	107	23.1	545	23.6	45	19.5	149	24.1	62	26.6
High nurse-to-bed ratio	417	60.1	98	91.6	315	57.8	42	93.3	102	68.4	56	90.3
Moderate nurse-to-bed ratio	132	19.0	8	7.5	107	19.6	2	4.4	25	16.8	6	9.7
Low nurse-to-bed ratio	145	20.9	1	0.9	123	22.6	1	2.2	22	14.8	—	0.0
Two or more rehabilitation therapies	444	15.1	161	34.7	397	17.2	117	50.6	47	7.6	44	18.9
High nurse-to-bed ratio	311	70.0	148	91.9	275	69.3	107	91.4	36	76.6	41	93.2
Moderate nurse-to-bed ratio	74	16.7	9	5.6	68	17.1	7	6.6	6	12.8	2	4.5
Low nurse-to-bed ratio	59	13.3	4	2.5	54	13.6	3	2.8	5	10.6	1	2.3

SOURCE: The Urban Institute: Merged data from projected cost report file 1980, projected to 1983, and the Medicare and Medicaid Automated Certification System file, 1980.

Table 8

Routine operating costs of skilled nursing facilities, by location, type of facility, number of rehabilitation therapies, and nurse-to-bed ratios

Number of rehabilitation therapies and nurse-to-bed ratios	All locations		Urban		Rural	
	Freestanding	Hospital-based	Freestanding	Hospital-based	Freestanding	Hospital-based
	Amount in dollars					
All facilities	$45.76	$77.88	$46.73	$91.62	$42.14	$64.02
No rehabilitation						
High nurse-to-bed ratio	43.43	70.44	44.17	90.68	41.21	59.81
Moderate nurse-to-bed ratio	39.51	57.77	39.66	54.29	39.02	60.10
Low nurse-to-bed ratio	42.62	66.19	43.19	85.65	40.39	46.72
One rehabilitation therapy						
High nurse-to-bed ratio	50.02	70.08	51.30	76.43	46.06	65.32
Moderate nurse-to-bed ratio	45.77	55.91	46.99	80.93	40.51	47.57
Low nurse-to-bed ratio	46.38	52.51	47.02	52.51	42.80	—
Two or more rehabilitation therapies						
High nurse-to-bed ratio	58.16	92.58	59.26	99.53	49.78	74.44
Moderate nurse-to-bed ratio	50.01	101.19	50.77	96.62	41.42	117.19
Low nurse-to-bed ratio	49.19	74.01	49.38	80.15	47.20	55.58

SOURCE: The Urban Institute: Merged data from projected cost report file 1980, projected to 1983, and the Medicare and Medicaid Automated Certification System file, 1980.

Table 9

Cost differences between hospital-based and freestanding facilities

Difference between hospital-based and freestanding facilities (1)	Pure difference (2)	Controlling for admissions—admissions per bed, percent of Medicare days, State and other facility characteristics (3)	Controlling for all variables in (3) plus patient characteristics (4)	Controlling for all variables in (4) plus staffing (5)
Total cost	$35.65	$27.42	$26.11	$23.03
Operating costs	28.35	19.31	18.51	16.31

NOTES: Differences reported in columns (2) and (3) will be different than those reported in the text of this article. Statistics reported in this table reflect only the sample of homes with data on patient characteristics and staffing.

Conclusions

In general, we have found that although significant differences do exist in the facility characteristics of hospital-based and freestanding SNF's, as currently measured, these different characteristics cannot fully explain existing cost differences. The contention that cost differences are primarily attributable to a more intensive case mix could not be confirmed by either proxy measurement (percent of Medicare days and admissions per bed) or more direct analysis of patient characteristic data. Substantial cost differences remain after controlling for both case-mix and staffing patterns.

Differences between hospital-based and freestanding homes after controlling for different explanatory variables are presented in Table 9. The results are based on those homes reporting data on costs, patient characteristics, and staffing. For these facilities, the pure observed difference per patient per day is $28.35 for operating costs and $35.65 for total costs. When all variables have been controlled for, differences are $16.31 for operating costs and $23.03 for total costs. These residual cost differences include the effect of Medicare overhead cost allocation procedures. As noted earlier, HCFA estimates this cost allocation effect to be between $2 and $5 per patient day for the period studied here. The magnitude of our unexplained cost differentials suggest at least the possibility that these estimates are low.

The implication for public reimbursement policy is that less than one-half of the observed difference in costs between hospital-based and freestanding facilities can be attributed to case-mix and staffing differences. It is probable that a more refined measure of case mix would yield a different estimate of the contribution of case mix to cost. However, it is not possible to state *a priori* whether such improved measures would account for a higher or lower proportion of the cost differences. Shaugnessy and Schlenker (1984), in their work on Colorado nursing homes, have estimated that approximately 50 percent of the difference in freestanding and hospital-based costs can be explained by case-mix differences. Given existing imprecision in the measurement of case mix, the recognition of one-half the cost difference as implemented under the current cost reimbursement system would appear to be an appropriate short-term policy. However, the risk in recognizing these differences and establishing higher ceilings for

provider-based facilities is that those hospital-based homes that do not have severely impaired patients or high staffing ratios would benefit and those freestanding homes who do would be penalized. This problem could be ameliorated in the short run by incorporating percent of Medicare days into the calculation of cost ceilings. The preferred long-term policy would adjust rates directly for patient characteristics and quality and ignore the hospital-based and freestanding distinction. However, until more refined data systems are developed to permit case-mix adjustment, percent of Medicare days could be used as a proxy measure.

Acknowledgments

This article was completed under a grant from the Health Care Financing Administration. The authors wish to thank Joshua Wiener, Korbin Liu, and Elizabeth Cornelius for their suggestions and insightful comments during the course of this project. In addition, they also thank two anonymous reviewers.

References

Cameron, J. A., and Knauf, R. A.: Case mix and resource use in long-term care. Paper presented at the Annual Meeting of the American Public Health Association. Montreal, Nov. 17, 1982.

Fries, B. E., and Cooney, L. M.: A Patient Classification System for Long-Term Care. Final report. Grant No. 18-P-97757/1-01. Grants and Contracts Report. HCFA Pub. No. 03179. Health Care Financing Administration. Washington. U.S. Government Printing Office, Aug. 1984.

Holahan, John: State rate-setting and its effects on the cost of nursing home care. *Journal of Health Politics, Policy and Law*. 9(4):647-667. Winter 1985.

McKnight, E.: *Nursing Home Research Study: Quantitative Measurement of Nursing Services*. U.S. Department of Health and Human Services, National Institutes of Health (NIH) Pub. No. 72-223, Oct. 1970.

New York State Department of Health and Rensselaer Polytechnic Institute: *New York State Long-Term Care Case-Mix Reimbursement Project*. Quarterly Reports to the Health Care Financing Administration.

Schlenker, R., and Shaugnessy, P.: Case-mix, quality, and cost relationships in Colorado nursing homes. *Health Care Financing Review*. Vol. 6, No. 2. HCFA Pub. No. 03195. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Dec. 1984.

Shaugnessy, P., Schlenker, R., and Yslaf, I.: Case-mix quality and cost: Major findings and implications of the Colorado nursing home study. Center for Health Services Research, University of Colorado Health Sciences Center. Denver, Colorado. 1984.

Shaugnessy, P., Kramer, A., Schlenker, R., and Polesovsky, M.: Nursing home case-mix differences between Medicare and non-Medicare and between hospital-based and freestanding patients. *Inquiry* 22(2):162-177. Summer 1985.

Stassen, M., and Bishop, C. E.: Incorporating case mix in prospective reimbursement for skilled nursing facility care under Medicare: Critical review of relevant research. Waltham, Mass. University Health Policy Consortium. Mar. 1983.

Waldo, D. R., and Lazenby, H. C.: Demographic characteristics and health care use and expenditures by the aged in the United States: 1977-84, *Health Care Financing Review*. Vol. 6, No. 1. HCFA Pub. No. 03176. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Sept. 1984.

Functional health measure for adjusting health maintenance organization capitation rates

by J. William Thomas and Richard Lichtenstein

Because of increasing interest in at-risk enrollment of Medicare beneficiaries by health maintenance organizations, a number of modifications to the adjusted average per capita cost (AAPCC) formula employed by the Health Care Financing Administration have been proposed recently. Researchers have found that new models, which include measures of prior years' utilization and costs, predict Medicare payments significantly better than does the purely demographic formula currently used. In this article, we show that inclusion of instrumental activities of daily living (IADL), a measure of beneficiaries' functional health status, can further improve AAPCC models that already incorporate measures of previous-period utilization and costs. Various models for predicting Medicare payments were examined and compared using survey data and Medicare claims for a random sample of 1,934 beneficiaries. For these models, explained variation in subsequent Medicare payments (as indicated by R^2 values) increased considerably when the IADL variable was included. Although actuarial concerns are associated with inclusion of the IADL score in the AAPCC, use of this measure is likely to offset other, possibly more serious, actuarial problems associated with including measures of previous utilization and costs.

Introduction

As Medicare at-risk contracts with health maintenance organizations (HMO's) become more prevalent, the validity of Medicare HMO capitation rates is acquiring increased importance. The Health Care Financing Administration (HCFA) is concerned that risk-sharing HMO's may be experiencing favorable selection in their Medicare enrollment (Eggers, 1980; Eggers and Prihoda, 1982) with consequent capitation overpayments. Juxtaposed against this concern are HMO fears of adverse selection and potential losses on Medicare contracts. At the heart of these concerns is the appropriateness of the adjusted average per capita cost (AAPCC), HCFA's formula for setting premiums for at-risk HMO's. The AAPCC is intended to represent an estimate of the costs that would have been incurred by a Medicare HMO enrollee had the beneficiary received care in the fee-for-service system. As such, it is an attempt by HCFA to calibrate HMO premiums to the expected cost of caring for a particular group of enrolled beneficiaries. Under the Tax Equity and Fiscal Responsibility Act of 1982, HMO's contracting on a risk basis with HCFA now receive capitation payments set at 95 percent of the AAPCC. This arrangement is designed to lower HCFA's expenditures for Medicare enrollees while providing HMO's incentives to deliver care more efficiently than the fee-for-service system does.

However, the actuarial factors currently used to calculate the AAPCC (age, sex, institutional status, and welfare status) have been shown to be poor predictors of costs for the Medicare population (Trieger, Galblum, and Riley, 1981). Alternative AAPCC models (that is, models that include other actuarial factors besides or in addition to the current ones) have been tested by researchers. In several studies, models that include measures of previous-period costs or utilization have been proven to provide significantly better financial predictions than does the purely demographic model now being used (e.g., Anderson, Resnick, and Gertman, 1982; Beebe, Lubitz, and Eggers, 1985; Eggers, 1981).

It has also been suggested that adding measures of beneficiary health status to the AAPCC would significantly improve its predictive capability (Luft et al., 1980; Trieger, Galblum, and Riley, 1981; Hornbrook, 1984; Anderson and Knickman, 1984). In an earlier article, we noted that the addition of health status measures might improve the AAPCC. We suggested direct measures of the beneficiary's physical health and functioning, such as measures of perceived health status and functional health status, as well as indirect measures, such as indicators of previous-period utilization and costs, which reflect beneficiaries' health-related behavior (Thomas et al., 1983).

In a recent study (Thomas et al., 1985), we tested various health status measures as predictors of future Medicare costs. Of the direct health status measures considered, the best single predictor was the instrumental activities of daily living (IADL) score, based on the Rosow-Breslau Functional Health Status Test (Rosow and Breslau, 1966). This measure explained 3.2 percent of the variance in Medicare payments when used alone (compared with 0.3 percent for the current AAPCC) and 3.9 percent when used with the demographic factors currently comprising the AAPCC formula.

This report was funded by the Health Care Financing Administration (Grant No. 18-P-98179/5-01).

Reprint requests: J. William Thomas, Department of Medical Care Organization, School of Public Health, University of Michigan, Ann Arbor, Michigan 48109.

The purpose of this article is to show that inclusion of the IADL score can further improve AAPCC models that already incorporate measures of previous-period utilization and costs. We use data from a randomly selected sample of Medicare beneficiaries in Michigan to examine several models based on utilization and costs that have been proposed by other researchers. Beneficiary IADL score is then added as another independent variable in each model to determine the degree to which predictions of Medicare payments are improved by including this health status measure. Based on these results, we suggest new models for more accurately predicting Medicare capitation rates.

Methods

Data

A random sample of 3,000 individuals was selected from the approximately 1,050,000 Medicare beneficiaries in Michigan. Data on demographic characteristics and self-rated health status of beneficiaries were obtained through a mail survey. Measures of medical services utilization and costs were developed by analyzing Medicare claims data, and data on beneficiary welfare status were provided by the Michigan Department of Social Services.

At the end of calendar year 1982, a survey instrument containing questions on health perceptions, functional ability, chronic illnesses, and living situation was mailed to the beneficiaries in the sample. Standard mail survey procedures, including several followup mailings to nonrespondents, were employed. Beneficiaries who had died or moved out of Michigan prior to the survey were dropped, as were those who could not respond because of mental disability. The survey yielded 2,123 responses for an adjusted response rate of 81.2 percent.

Medicare claims data for sample beneficiaries were provided by Blue Cross/Blue Shield of Michigan, the Medicare intermediary and carrier for the State. The year prior to the survey (January 1, 1982, through December 31, 1982) and the 6-month period following the survey (January 1, 1983, through June 30, 1983) were covered. Receipt of claims data for the January–June 1983 period was postponed until December 1983 to accommodate routine delays in claims filing and processing. The choice of 6 months as the length of the postsurvey data collection period was influenced by these delays and represented a compromise between the quantity of claims data obtainable and the need for timely analytical results.

Because available claims data covered only services provided in Michigan, respondents were resurveyed in late 1983 to determine whether medical services had been received in other States during the study period. Not surprisingly, utilization outside Michigan was found to be concentrated among residents of border counties, i.e., those adjacent to neighboring States. To eliminate bias from underreporting of utilization, beneficiaries having any hospitalizations or more than three physician visits outside Michigan were dropped from the study, leaving data on 1,934 persons for the analyses.

The AAPCC currently includes welfare status (which is actually operationalized as Medicaid eligibility) as an actuarial factor. HCFA determines Medicaid eligibility by identifying beneficiaries for whom the Medicare supplementary medical insurance (Part B) premium is paid by Medicaid. For this study, data on Medicaid eligibility were obtained directly from the Michigan Department of Social Services, the Medicaid agency.

Variables

In the analyses presented in this article, the dependent variable, total Medicare payments made on behalf of the beneficiary during January–June 1983, is regressed on beneficiary IADL score, demographic characteristics, and prior-year utilization and costs.

Dependent variable

Claims data used in this study cover periods before implementation of the prospective payment system. Medicare payments, which then were based on retrospective cost reimbursement, could have varied for equivalent services from hospital to hospital. To eliminate the effect of interinstitutional rate and cost differences, each discharge was assigned to a diagnosis-related group (DRG) using the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM), Medicare Provider Analysis and Review (MEDPAR) Grouper algorithm (Public Health Service and Health Care Financing Administration, 1980). Based on actual Medicare payments for these discharges, an average payment was calculated for each DRG represented in the data set. Standardized inpatient service payments then were tabulated for each beneficiary using these DRG averages.

No method comparable to DRG's exists for standardizing other categories of Medicare payments. Thus, the dependent variable for the study, January–June 1983 standardized total Medicare payments, was created as the sum of standardized hospital insurance (Part A) inpatient service payments (representing 69.5 percent of total payments) plus actual payments for supplementary medical insurance (Part B) services, Part A outpatient services, Part A home health services, and Part A skilled nursing facility services. For the 1,934 beneficiaries in the final sample, the minimum value of standardized total Medicare payments for January–June 1983 was $0, the maximum was $26,416, and the mean standardized payment for the 6-month period was $932.

Demographic characteristics

Independent variables used in the analyses are described in Table 1. Examination of current AAPCC

Table 1

Minimum, maximum, and mean of independent variables for regressions on January–June 1983 standardized payments

Variable	Minimum	Maximum	Mean
Age[1]	68	100	76.18
Sex (1 = female)	0	1	.61
Institutional status (1 = yes)	0	1	.02
Medicaid (1 = yes)	0	1	.06
IADL[2] score	0	5	3.04
Number of Part B claims, 1982	0	450	21.47
Number of emergency room visits, 1982	0	8	.17
Number of inpatient admissions, 1982	0	7	.34
Number of inpatient days, 1982	0	196	3.52
1982 standardized payments (in dollars)	0	46,818	1,518.80
Hospitalization in 1982 (1 = yes)	0	1	.22
1 hospitalization, 1982 (1 = yes)	0	1	.15
More than 1 hospitalization, 1982 (1 = yes)	0	1	.07
Hospitalization in 1982:			
Non-high-cost diagnosis only (1 = yes)	0	1	.07
Secondary diagnosis (1 = yes)	0	1	.06
High-cost diagnosis, 20 days or less (1 = yes)	0	1	.06
High-cost diagnosis, more than 20 days (1 = yes)	0	1	.04
Reimbursement but no hospitalization (1 = yes)	0	1	.54
Part B deductible met (1 = yes)	0	1	.74

[1] As of June 1983.
[2] Instrumental activities of daily living.

NOTE: Information shown is based on answers of 1,934 survey respondents.

Table 2

Questions and responses relating to instrumental activities of daily living

Question	Yes	No
	Percent	
Can you walk up and down stairs to the second floor without help?	86.6	13.4
Can you go out to a movie, a meeting, to church or synagogue, or to visit friends without help?	81.5	18.5
Can you walk half a mile without help?	67.4	32.6
Can you do heavy work around the house, like shoveling snow or washing walls, without help?	37.6	62.4
Is there any physical condition, illness, or health problem that bothers you now?[1]	68.9	31.1

[1] For scaling purposes, this item is reverse scored.

NOTE: Information shown is based on answers of 1,934 survey respondents.

factors shows that the mean age of sample beneficiaries was 76 years, 61 percent were women, only 2.1 percent resided in institutions, and 5.6 percent were covered under Medicaid.

IADL score

The instrumental activities of daily living score is based on responses to the questions listed in Table 2. As may be observed from the right-hand column of the table, these responses form a Guttman scale with a coefficient of reproducibility equal to 0.9301. Scale values range from 0 for respondents who reported a health problem and could perform none of the functions without assistance to 5 for those who could perform all listed activities and reported no bothersome physical or health problem.

Prior-period utilization and costs

Standardized total Medicare payments for calendar year 1982, the year preceding the mail survey, were computed for each beneficiary using the DRG procedure described earlier. Total numbers of inpatient admissions, acute inpatient days, hospital emergency room visits, and Part B claims submitted during the period were also tabulated for each beneficiary.

In addition to these counts of 1982 utilization, several binary (0/1) measures were constructed to allow testing of models previously proposed by Beebe, Lubitz, and Eggers (1985) and Anderson, Resnick, and Gertman (1982). In one of the models examined by Beebe, Lubitz, and Eggers (1985), a binary measure indicating whether a beneficiary's Part B deductibles had been met during either of the 2 previous years was included as an independent variable. Our data base contained utilization data for only 1 prior year, so we were unable to replicate this variable exactly. Instead, the variable in Table 1 relating to the Part B deductible was constructed by assigning a value of 1 if any Part B payments were

made on behalf of a beneficiary in 1982 and a value of 0 otherwise. For 74 percent of the sample beneficiaries, the Part B deductible was satisfied in 1982.

In another model tested by Beebe, Lubitz, and Eggers (1985), a binary variable was included to indicate beneficiaries who had been hospitalized during the preceding year. As shown in Table 1, this variable is assigned a value of 1 for beneficiaries hospitalized for any reason during 1982 and a value of 0 for those not hospitalized. Of the sample beneficiaries 22 percent were admitted to a hospital during 1982.

Among the independent variables tested by Anderson, Resnick, and Gertman (1982) was a measure that was assigned a value of 1 if Medicare payments were made on the beneficiary's behalf during the prior year but the beneficiary was not hospitalized during that year. In the same model, a second binary variable was used to identify beneficiaries who had been hospitalized once during the previous year and a third variable to indicate those who had been admitted two or more times to a hospital. Of the 1,934 beneficiaries in the Michigan sample, 15.2 percent were hospitalized one time, 7.1 percent were hospitalized two or more times, and 53.9 percent were not hospitalized but received services for which Medicare payments were made.

For another model, Anderson, Resnick, and Gertman (1982) developed a list of hospital discharge diagnoses that were found to be associated with high costs in the subsequent year. Most cancers and heart conditions and many other chronic diseases were included in the list of high-cost diagnoses. Using this list, Medicare hospital claims were analyzed and beneficiaries who had been hospitalized during the previous year were assigned to one of the following categories:

- One or more hospitalizations in prior year but none involving a diagnosis on the high-cost list or a secondary diagnosis.
- One or more hospitalizations in prior year, at least one involving a secondary diagnosis, but none involving a diagnosis on the high-cost list.
- One or more hospitalizations in prior year, with at least one diagnosis on the high-cost list, but with total hospital days not exceeding 20.
- One or more hospitalizations in prior year, with at least one diagnosis on the high-cost list and with more than 20 total hospital days.

In their analyses, Anderson, Resnick, and Gertman (1982) employed 1974-75 Medicare data in which diagnoses were identified using the coding system of the *Eighth Revision International Classification of Diseases, Adapted for Use in the United States* (ICDA-8) (National Center for Health Statistics, 1967). For use with 1982-83 Michigan data, the three-digit ICDA-8 codes defining the list of high-cost diagnoses were translated into three-digit ICD-9-CM codes. Discharge diagnoses and lengths of stay for 1982 hospitalizations then were used to classify sample beneficiaries into the categories defined above. As shown in Table 1, 7 percent of sample beneficiaries were hospitalized in 1982 without a high-cost diagnosis and with no secondary diagnosis, 6 percent had a secondary diagnosis and fell into the second group, and 6 percent and 4 percent were classified into the third and fourth groups, respectively. Correlations among the independent variables are shown in Table 3.

Results

Table 4 shows results from analyses of Michigan data using models proposed by Beebe, Lubitz, and Eggers (1985), Anderson, Resnick, and Gertman (1982), and Eggers (1981). Although other models have also been suggested in the literature, we believe those identified in Table 4 to be representative of current AAPCC-related research. In selecting models, we of course limited our consideration to those based on variables that were available or could be constructed from our data base.

Model 1 includes current AAPCC factors plus a binary variable that indicates whether the beneficiary was admitted to a hospital during the previous year. Using a sample of approximately 21,000 records from the Medicare Health Insurance Master Accretions file, Beebe, Lubitz, and Eggers (1985) found this model (excluding institutional status, on which they had no information) to explain 2.2 percent of the variance in 1976 Medicare payments per enrollee. With 1982-83 Michigan data, this model explains 4.6 percent of dependent variable variance (Table 4). Although Beebe, Lubitz, and Eggers (1985) found the regression coefficients for age, sex, and Medicaid buy-in to be significant at the 0.05 level with Model 1, coefficients for these variables in our analysis were not significant at even the 0.1 level. This may be attributable to our smaller sample size.

Using a formulation similar to Model 2, Beebe, Lubitz, and Eggers (1985) measured prior utilization with two variables, one indicating the number of hospital days used during the previous 2 years and the other indicating whether the Part B deductible was met during this period. With their sample, Beebe, Lubitz, and Eggers (1985) found this model to yield an R^2 value of 0.043. As noted earlier, the variables in our study representing number of hospital days and Part B deductible relate to the 12 months of calendar year 1982 instead of the 24-month period used by Beebe, Lubitz, and Eggers (1985). Nevertheless, this model explains 5.0 percent of the variance in January–June 1983 standardized payments, a value relatively close to that found by Beebe, Lubitz, and Eggers (1985) with their larger data set.

Models 3, 4, and 5 were proposed and tested by Anderson, Resnick, and Gertman (1982) using a sample of approximately 13,500 cases from Los Angeles County and data from the Medicare history file for 1974–75. Model 3 is similar to Model 2 except that it does not include a variable indicating whether the Part B deductible was met. With Los Angeles data, Anderson, Resnick, and Gertman (1982) found

Table 3

Correlations (Pearson's *r*) among potential independent variables

Variable	Age	Sex	Institutional status	Medicaid	IADL[1]	Number of— Part B claims	Emergency room visits	Inpatient admissions	Inpatient days	1982 standardized payments	Hospitalization Any	Hospitalization 1	Hospitalization More than 1	Hospitalization diagnosis Non-high-cost only	Hospitalization diagnosis Secondary	Hospitalization diagnosis High-cost 20 days or less	Hospitalization diagnosis High-cost More than 20 days	Reimbursement but no hospitalization	Part B deductible met
Age	1.00																		
Sex	.08	1.00																	
Institutional status	.12	.02	1.00																
Medicaid	.06	.08	.36	1.00															
IADL[1] score	−.22	−.20	−.24	−.24	1.00														
Number of Part B claims, 1982	.02	.03	.13	.09	−.25	1.00													
Number of emergency room visits, 1982	.03	.00	.06	.10	−.11	.16	1.00												
Number of inpatient admissions, 1982	.06	−.03	.12	.12	−.27	.44	.25	1.00											
Number of inpatient days, 1982	.04	−.02	.18	.14	−.26	.45	.26	.84	1.00										
1982 standardized payments	.04	−.03	.15	.13	−.29	.55	.30	.90	.90	1.00									
Hospitalization in 1982	.08	−.05	.09	.06	−.26	.38	.15	.81	.61	.70	1.00								
1 hospitalization, 1982	.07	−.05	.04	.00	−.16	.19	.04	.36	.24	.28	.79	1.00							
More than 1 hospitalization, 1982	.03	−.01	.10	.10	−.20	.35	.20	.81	.65	.74	.52	−.12	1.00						
Non-high-cost diagnosis only	.03	−.06	.00	.02	−.07	.10	.03	.29	.15	.19	.51	.53	.08	1.00					
Secondary diagnosis	.06	−.01	.07	.01	−.14	.14	.03	.32	.21	.24	.46	.41	.17	−.07	1.00				
High-cost diagnosis, 20 days or less	.03	−.01	.01	.00	−.13	.18	.07	.31	.17	.27	.48	.43	.17	−.07	−.06	1.00			
High-cost diagnosis, more than 20 days	.03	−.01	.10	.10	−.17	.31	.17	.62	.67	.65	.36	−.01	.61	−.05	−.05	−.05	1.00		
Reimbursement but no hospitalization	.05	−.07	−.02	−.01	.07	−.01	.00	−.47	−.35	−.37	−.58	−.46	−.30	−.29	−.27	−.28	−.21	1.00	
Part B deductible met	.02	.01	.06	.02	−.18	−.38	.13	.25	.19	.26	.31	.24	.16	.16	.13	.15	.11	.55	1.00

[1] Instrumental activities of daily living.

NOTES: For consistency, the Pearson's *r* statistic is reported for all variable combinations in the table. Although not reported, Kendall's *tau* was checked for nominal/ordinal scaled variables. Information shown is based on answers of 1,934 respondents.

Table 4

Regressions on January–June 1983 standarized payments using variables from models proposed by other researchers

Variable	Model 1[1]	Model 2[1]	Model 3[2]	Model 4[2]	Model 5[2]	Model 6[3]
R^2	.046	.050	.039	.071	.063	.058
			Coefficient			
Age	−.026	−.015	−.015	−.023	−.025	−.018
Sex	−.023	−.030	−.028	−.029	−.028	−.024
Institutional status	−.001	−.017	−.014	−.009	−.011	—
Medicaid	.031	.023	.022	.021	.024	—
Hospitalization in 1982	***.209	—	—	—	—	—
1 hospitalization, 1982	—	—	—	***.163	—	—
More than 1 hospitalization, 1982	—	—	—	***.275	—	—
Hospitalization in 1982:						
Non-high-cost diagnosis	—	—	—	—	***.128	—
Secondary diagnosis	—	—	—	—	***.151	—
High-cost diagnosis, 20 days or less	—	—	—	—	***.127	—
High-cost diagnosis, more than 20 days	—	—	—	—	***.210	—
Number of inpatient days, 1982	—	***.174	***.193	—	—	—
1982 standardized payments	—	—	—	—	—	***.240
Reimbursement but no hospitalization	—	—	—	***.105	***.105	—
Part B deductible met	—	***.104	—	—	—	—

***Significant at the 0.01 level.
[1](Beebe, Lubitz, and Eggers, 1985).
[2](Anderson, Resnick, and Gertman, 1982).
[3](Eggers, 1981).

NOTE: Information shown is based on answers of 1,934 survey respondents.

that this model yielded an R^2 value of 0.055, with age, sex, welfare status, and number of hospital days all having significant coefficients at the 0.05 level or better. With our sample, the model explains 3.9 percent of the variance in January–June 1983 standardized payments, and none of the demographic variables has significant coefficients (Table 4).

Model 4 includes several more detailed measures of utilization than those employed in Model 3. With the data used by Anderson, Resnick, and Gertman (1982), Model 4 explained 6.2 percent of the variance in subsequent-year payments, a figure close to the 7.1 percent shown in Table 4.

Model 5 was proposed by Anderson, Resnick, and Gertman (1982) and includes information on discharge diagnoses for hospitalizations occurring during the previous year. With Michigan data, all utilization and cost variables in this model are significant at the 0.01 level or better, but none of the demographic variables is significant. The model explains 6.3 percent of the variance in subsequent-year payments, a figure similar to the 6.6 percent found by Anderson et al.

Model 6 was suggested by Eggers (1981) and involves only age, sex, and prior-year payments as predictors of subsequent-year payments. Using this model to analyze data from the Medicare history file for a random sample of approximately 13,600 beneficiaries for 1978–79, Eggers found the model to explain 4.9 percent of variance in subsequent-year payments for all beneficiaries in the sample and 4.2–7.3 percent for selected subarea samples. These results are comparable with the 5.8-percent figure shown in Table 4.

Models supplemented by IADL score

In Table 5, results are shown for a set of regression analyses using the models from Table 4 supplemented by the IADL measure of beneficiary health status. Several interesting observations can be made from these results. First, the R^2 for every model is increased by adding the IADL measure. The smallest increase is for Model 4, in which R^2 rises from 0.071 to 0.087; the largest is for Model 3, with an increase in the R^2 value from 0.039 to 0.062. Coefficients for the utilization and cost variables remain significant, although the magnitude of these coefficients decreases with the introduction of IADL into the model. Lastly, although coefficients for the age and sex variables were not significant in any of the models in Table 4, age and/or sex are significant at the 0.05 level or better in every one of the models in Table 5. Apparently, controlling for functional health status reveals relationships between Medicare payments and sex (and, to a lesser degree, age) that are not otherwise apparent.

We can conclude from Tables 4 and 5 that even models that already include indirect measures of health status in the form of variables representing prior utilization and/or reimbursement can provide more accurate predictions of future Medicare payment levels if supplemented by a direct health status measure.

Table 5

Regressions on January–June 1983 standarized payments using variables from models proposed by other researchers supplemented by IADL[1] score

Variable	Model 1a[2]	Model 2a[2]	Model 3a[3]	Model 4a[3]	Model 5a[3]	Model 6a[4]
R^2	.066	.069	.062	.087	.080	.075
			Coefficient			
Age	**−.052	*−.042	*−.043	**−.046	**−.048	**.044
Sex	**−.052	**−.057	**−.058	**−.053	**−.054	−.051
Institutional status	−.024	−.037	−.036	−.029	−.031	—
Medicaid	.007	.001	−.002	−.000	.003	—
Hospitalization in 1982	***.171	—	—	—	—	—
1 hospitalization, 1982	—	—	—	***.130	—	—
More than 1 hospitalization, 1982	—	—	—	***.242	—	—
Hospitalization in 1982:						
Non-high-cost diagnosis only	—	—	—	—	***.109	—
Secondary diagnosis	—	—	—	—	***.126	—
High-cost diagnosis, 20 days or less	—	—	—	—	***.100	—
High-cost diagnosis, more than 20 days	—	—	—	—	***.183	—
Number of inpatient days, 1982	—	***.145	***.158	—	—	—
1982 standardized payments	—	—	—	—	—	***.200
Reimbursement but no hospitalization	—	—	—	***.090	***.090	—
Part B deductible met	—	***.085	—	—	—	—
IADL[1] score	***−.160	***−.157	***−.169	***−.144	***.146	***−.142

* Significant at the 0.10 level.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.
[1] Instrumental activities of daily living.
[2] (Beebe, Lubitz, and Eggers, 1985).
[3] (Anderson, Resnick, and Gertman, 1982).
[4] (Eggers, 1981)

NOTE: Information shown is based on answers of 1,934 survey respondents.

Table 6

Regressions on January-June 1983 standardized payments using age, sex, IADL[1] score, and measures of utilization and cost

Variable	Model 7	Model 8
R^2	.096	.092
	Coefficient	
Age	**−.045	**−.045
Sex	**−.053	**−.053
1 hospitalization, 1982	***.089	***.060
More than 1 hospitalization, 1982	***.184	***.167
Number of Part B claims, 1982	***.096	***.113
Number of emergency room visits, 1982	**.050	—
Reimbursement but no hospitalization	*.054	—
IADL[1] score	***−.122	***−.128

* Significant at the 0.10 level.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.
[1] Instrumental activities of daily living.

NOTE: Information shown is based on answers of 1,934 survey respondents.

Other models

For this sample of Michigan beneficiaries, payments for acute inpatient services represented 62 percent of total Medicare costs in 1982 and 70 percent in the first 6 months of 1983. The emphasis on hospitalization-related utilization variables in the models shown in Tables 4 and 5 thus appears appropriate. However, Part B and Part A outpatient payments also accounted for significant fractions of total Medicare costs, 36.5 percent in 1982 and 28.6 percent in January–June 1983. Therefore, the predictive validity of the models might be improved by including variables more specifically related to outpatient activities.

In Table 6, ambulatory utilization is represented by three variables: number of Part B claims filed during 1982, number of emergency room visits in 1982, and the binary variable indicating whether Medicare payments were made during 1982 for an individual who had no hospitalizations. Inpatient utilization is indicated by two binary variables from Model 4: one is assigned a value of 1 if the beneficiary had exactly one hospitalization in the previous year; the other is assigned a value of 1 if two or more hospitalizations occurred. Age and sex variables are included in these models because they were observed to be significant for models which also incorporate IADL.

Variables used in Model 7 for prior utilization and costs were selected based on their contributions to explained variance and their lack of correlation with other independent variables. On the basis of these considerations, Model 7 represents the best set of

independent variables identified thus far in that it produces the highest R^2, 0.096.

Model 8 is more parsimonious than Model 7 in that two of the utilization-cost variables are dropped. The reduction in R^2 because of eliminating the number of emergency room visits and the binary variable for Medicare reimbursement with no hospitalizations is only 0.004. The resulting model predicts Medicare payments based only on age and sex, number of Part B claims, IADL, and two variables for inpatient hospitalizations. Except for Model 7, Model 8 explains more variance in future payments than any of the models previously considered.

Although Model 7 has a higher R^2 value than the other models for predicting Medicare payment levels, it still accounts for less than 10 percent of variance in payments. The primary reason for the relatively small R^2 values achieved in this and other AAPCC-related studies is the skewness of the distribution of Medicare payments. As shown in Figure 1, a few beneficiaries incur high costs that are reimbursed by Medicare, and many other beneficiaries incur no reimbursable expenses. The extreme skewness of the Medicare payments distribution violates one of the assumptions of ordinary least squares regression, that of a normally distributed dependent variable. As a result, regression models tend to underestimate payment levels for those at the high end of the distribution. Because R^2 reflects squared deviations between actual and predicted values, the effects of these underestimates may be quite large. Thus R^2 values with the untransformed dependent variable are lower than those generally encountered in other research using appropriately specified models.

Perhaps a better sense of the accuracy of various models for predicting subsequent-year reimbursement is gained when the distribution of the dependent variable is normalized by using the logarithm of January-June 1983 standardized payments as the dependent variable instead of the actual value.

Table 7 lists R^2 values achieved for Models 4-6 (Table 4), Models 4a-6a (Table 5), and Models 7 and 8 (Table 6) when the natural log of January-June 1983 standardized payments is used as the dependent variable. For every model, the percentage of explained variation in standardized payments is much greater when the log transform is used. In terms of R^2 value, Model 7 is better than the other models using either the untransformed dependent variable or the log transform dependent variable. With the exception of Models 6 and 6a, all of the models listed in Table 7 are based on measures of prior utilization, and the relative rankings of these models in terms of R^2 values are not changed by use of the transformed dependent variable.

The predictive power of Models 6 and 6a, which include measures of prior payments instead of prior utilization, is greatly enhanced through use of the log transformation of the payment variables. With the untransformed variables, Model 6 yields an R^2 of 0.058, the lowest of all of the models listed in Table 7, and R^2 for Model 6a ranks near the middle.

Table 7

Performance (R^2) of selected models using untransformed and log transformed dependent variable[1]

Model and model variables	R^2 untransformed dependent variable	R^2 log transformation of dependent variable
Model 4[2]		
Age; sex; institutional status; Medicaid; reimbursement but no hospitalization; 1 hospitalization; more than 1 hospitalization	.071	.173
Model 4a[2]		
Model 4 plus IADL[3] score	.087	.189
Model 5[2]		
Age; sex; institutional status; Medicaid; reimbursement but no hospitalization; hospitalization with non-high-cost diagnosis; hospitalization with secondary diagnosis; hospitalization with high-cost diagnosis, 20 days or less; hospitalization with high-cost diagnosis, more than 20 days	.063	.169
Model 5a[2]		
Model 5 plus IADL[3] score	.080	.185
Model 6[4]		
Age; sex; 1982 standardized payments[5]	.058	.217
Model 6a[4]		
Model 6 plus IADL[3] score	.075	.230
Model 7		
Age; sex; 1 hospitalization; more than 1 hospitalization; number of Part B claims; number of emergency room visits; reimbursement but no hospitalization; IADL[3] score	.096	.236
Model 8		
Age; sex; 1 hospitalization; more than 1 hospitalization, number of Part B claims; IADL[3] score	.092	.198

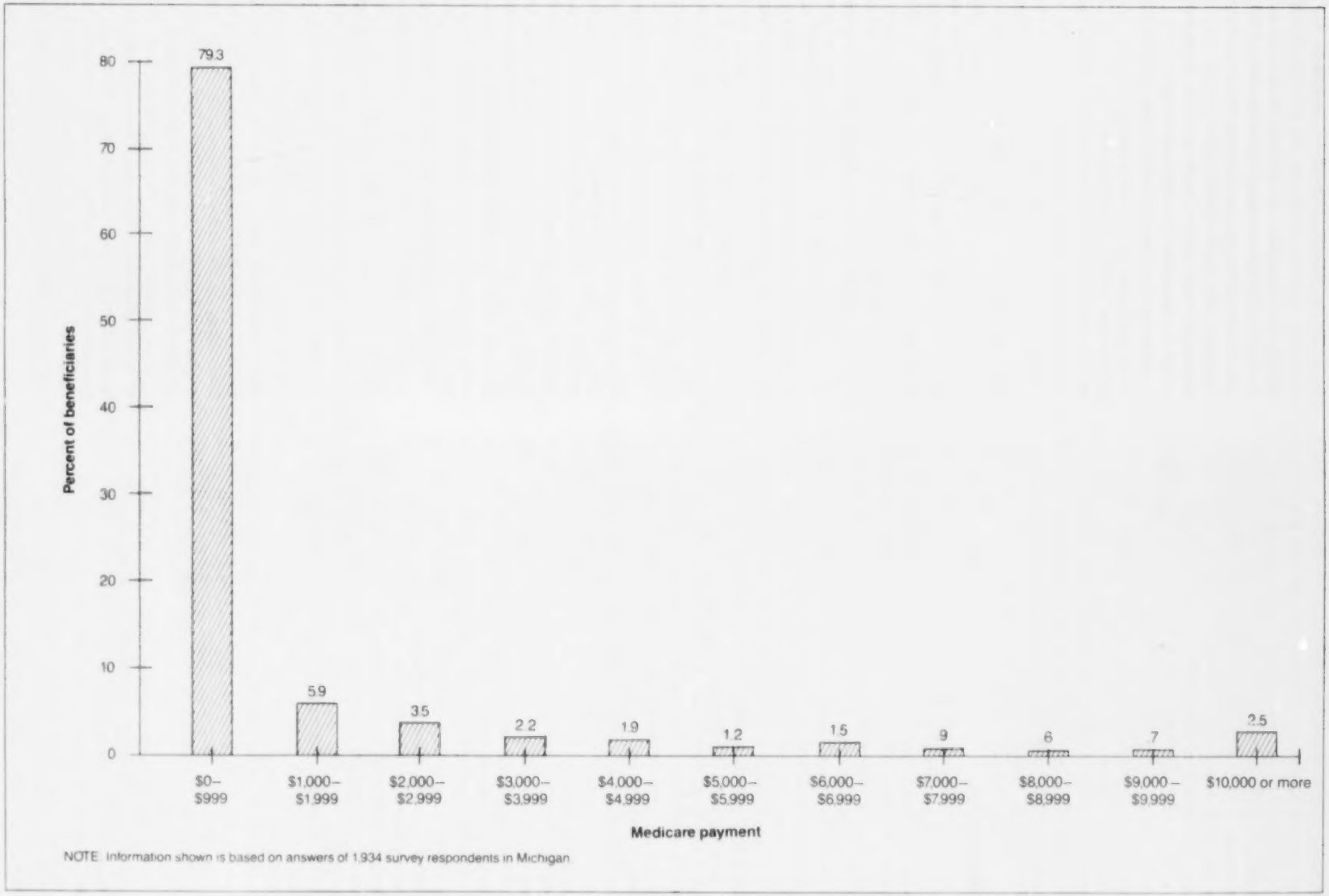
[1] January–June 1983 standardized payments.
[2] (Anderson, Resnick, and Gertman, 1982).
[3] Instrumental activities of daily living.
[4] (Eggers, 1981).
[5] For regression on log transformation of dependent variable, 1982 standardized payments variable is also transformed.

NOTE: Information shown is based on answers of 1,934 survey respondents.

best copy available

Figure 1

Percent distribution of Medicare beneficiaries, by January-June 1983 standardized payments



NOTE: Information shown is based on answers of 1,934 survey respondents in Michigan.

However, when the independent and dependent payment variables are transformed, Models 6 and 6a are among the best, with Model 6a producing an R^2 value of 0.230, only slightly less than the R^2 achieved in Model 7. A likely explanation for this improvement in the predictive power of models based on prior-year payments is that these models predict reasonably well for all cases except those involving very high payment levels. With the log transforms, the tail of the payment variable distribution is "shortened," and differences between actual and predicted values are relatively smaller. This suggests that these models, particularly 6a, are likely to be better predictors of future Medicare payments than is indicated by their R^2 values in Tables 4 and 5.

Discussion

Depending on the characteristics of enrolled beneficiaries, a risk-sharing HMO can experience large and systematic profits or losses if capitation levels are based on an inadequately specified AAPCC formula. From HCFA's perspective, neither of these outcomes is desirable. If they are to be avoided and if calculated capitation payments are to relate more closely to HMO's costs of providing services to Medicare enrollees, a more accurate and precise AAPCC formula must be devised.

In presenting the regression results, we have examined and compared the ability of alternative AAPCC models to predict future Medicare payments, predictive ability being measured by model R^2. In terms of this criterion, the results indicate that models incorporating measures of prior-period utilization and costs are superior to the purely demographic model currently used by HCFA. The results also show that predictions of future payments are even further improved by adding beneficiary IADL score to AAPCC models that incorporate measures of utilization and/or costs.

Although ability to predict future costs is a principal criterion for selecting new factors for the AAPCC, other actuarial characteristics of these factors must be considered as well. Primary among these characteristics is the degree to which a factor is potentially subject to direct or indirect manipulation by HMO's or other providers. Any payment formula involves implicit financial incentives. In revising the AAPCC, HCFA must consider the ways in which a potential actuarial factor may influence these incentives and how providers and patients may behave in response. The potential benefits and problems of incorporating a new factor must be weighed against the benefits and problems that are likely to occur if it is not included.

Information on beneficiary IADL scores is not currently collected for the Medicare population. If IADL were to be included in the AAPCC, HCFA would have to develop a method for acquiring the necessary data. Data might be obtained by having the HMO's survey their enrollees directly. However, HMO providers might have both the motivation and the ability to influence enrollees' responses to IADL questions, thereby increasing the HMO's AAPCC payments. Therefore, procedures for detecting such abuses would be necessary. Other means of collecting this information, such as through third parties or through direct mailings by HCFA or its intermediaries, may be more costly to implement but would be less subject to manipulation.

Although collection of IADL data for all Medicare HMO enrollees may present administrative difficulties, HCFA must also consider the problems of not including IADL in the AAPCC formula. Because IADL has been shown to be a good predictor of future health services use and costs, HMO's might employ this indicator of functional health to their own advantage when marketing to Medicare beneficiaries. For example, an HMO might advertise that it is currently enrolling Medicare beneficiaries at its office on the second floor of its downtown building. Beneficiaries who could not walk up and down stairs without help or who could not go out without help (two IADL functions) would be less likely to respond to this solicitation, leaving the HMO with a biased selection of enrollees. Yet the current AAPCC formula would not take account of this bias, and the HMO would be paid as if it enrolled a cross-section of the elderly community. Incorporating IADL into the AAPCC formula would eliminate the advantage to HMO's of implicitly or explicitly using this type of selective marketing strategy because the HMO would be paid lower premiums for healthier enrollees.

Similar issues must be considered if measures of previous use and costs are to be included in the AAPCC. First, HCFA would have to engage in special data collection activities to determine the prior use and cost experience of beneficiaries when they become eligible for the program for the first time at age 65. Although these data may be readily available through HMO or insurance company records for some new enrollees, they would be difficult to collect for others.

Second, variables for prior use and cost could also be used by HMO's to obtain favorable selection. A higher AAPCC rate associated with hospitalization in the previous year could encourage HMO's to identify and enroll Medicare patients who had been admitted to a hospital for elective procedures or other nonrecurrent problems. Based on prior hospitalization, the HMO would then receive the higher capitation rate for patients who are no more likely to be hospitalized than other beneficiaries are. Depending on the size of the incremental payment, a capitation increment associated with prior hospitalization might also reduce the HMO's incentive to keep patients out of the hospital because a portion of hospitalization costs would be recouped through subsequent increases in capitation. Defining hospitalization factors on the basis of high-cost diagnoses, as suggested by Anderson, Resnick, and Gertman (1982) and shown in Models 5 and 5a,

reduces the incentives for, and likelihood of, this type of manipulation.

In general, including any prior-utilization factor in the AAPCC could promote unnecessary use if the associated capitation increment exceeds the HMO's marginal cost of providing the service. If the number of hospital days in the previous year were included as a factor, for example, the AAPCC increment associated with an additional day (or block of days) should not exceed the marginal cost to the HMO of extending the patient's stay. This is particularly relevant for ambulatory use measures, such as reimbursement, Part B deductible met, or number of Part B claims, for which associated marginal costs are likely to be low.

The incremental change in the AAPCC that is appropriate for a unit change in utilization is indicated in the tables by the coefficient for the particular utilization measure selected. Coefficients of the utilization variables are smaller in magnitude for models that include IADL along with one or more measures of utilization (Table 5) than for models that do not include IADL (Table 4). For example, the coefficient for hospitalization with non-high-cost diagnosis only in Model 5 is 0.128 (Table 4), but the coefficient for the same variable in Model 5a, which includes IADL, is 0.109. The coefficient for 1982 standardized payments is 0.240 in Model 6 but only 0.200 in Model 6a. Thus, if measures of prior utilization or costs are included in the AAPCC, adding the IADL score is likely to reduce the utilization increment, thereby reducing the financial incentive for HMO's to "game" the system.

In summary, incorporating the IADL score as an AAPCC adjusting factor may improve predictions of beneficiary costs and reduce the likelihood of HMO's selectively marketing to promote favorable selection. If used in conjunction with measures of prior utilization or costs, it may reduce incentives for HMO's to manipulate the capitation rate through promoting unnecessary use of services. HCFA must weigh these benefits against the likely costs and potential difficulties involved in obtaining IADL data from beneficiaries.

References

Anderson, G., and Knickman, J.: Implications for adverse selection under a voucher system: The grouping of Medicare recipients by level of expenditure. *Inquiry* 21(2):135-143, 1984.

Anderson, J. J., Resnick, A. L., and Gertman, P. M.: Prediction of Subsequent Year Reimbursement Using the Medicare History File. Unpublished document. Boston University Medical Center, University Health Policy Consortium. Boston, 1982.

Beebe, J., Lubitz, J., and Eggers, P.: Using prior utilization information to determine payments for Medicare enrollees in health maintenance organizations. *Health Care Financing Review*. Vol. 6, No. 3. HCFA Pub. No. 03198. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Spring 1985.

Eggers, P.: Risk differential between Medicare beneficiaries enrolled and not enrolled in an HMO. *Health Care Financing Review*. Vol. 1, No. 3. HCFA Pub. No. 03027. Office of Research, Demonstrations, and Statistics, Health Care Financing Administration. Washington. U.S. Government Printing Office, Winter 1980.

Eggers, P.: Analysis of the Relationship Between Reimbursements in One Year and Reimbursements in a Subsequent Year. Working Paper OR-33. Office of Research, Demonstrations, and Statistics, Health Care Financing Administration. Baltimore, Md., 1981.

Eggers, P. W., and Prihoda, R.: Pre-enrollment reimbursement patterns of Medicare beneficiaries enrolled in "at-risk" HMO's. *Health Care Financing Review*. Vol. 4, No. 1. HCFA Pub. No. 03146. Office of Research, Demonstrations, and Statistics, Health Care Financing Administration. Washington. U.S. Government Printing Office, Sept. 1982.

Hornbrook, M. C.: Examination of the AAPCC methodology in an HMO prospective payment demonstration project. *The Group Health Journal* 5(1):13-21, 1984.

Luft, H. S., Feder, J., Holahan, J., and Lennox, K. D.: Health maintenance organizations. In Feder, J., Holahan, J., and Marmor, T., eds. *National Health Insurance: Conflicting Goals and Policy Choices*. Washington, D.C. The Urban Institute, 1980.

National Center for Health Statistics: *Eighth Revision International Classification of Diseases, Adapted for Use in the United States*, DHEW Pub. No. (PHS) 1693. Public Health Service. Washington. U.S. Government Printing Office, 1967.

Public Health Service and Health Care Financing Administration: *International Classification of Diseases, 9th Revision, Clinical Modification*. DHHS Pub. No. (PHS) 80-1260. Public Health Service. Washington. U.S. Government Printing Office, Sept. 1980.

Rosow, I., and Breslau, N.: A Guttman health scale for the aged. *J Gerontol* 21(4):556, 1966.

Thomas, J. W., Lichtenstein, R., Wyszewianski, L., and Berki, S. E.: Increasing Medicare enrollment in HMO's: The need for capitation rates adjusted for health status. *Inquiry* 20(3):227-239, 1983.

Thomas, J. W., Lichtenstein, R., Wyszewianski, L., and Berki, S. E.: *Final Report: A Health Status Measure for Adjusting the HMO Capitation Rates of Medicare Beneficiaries*. Prepared for Health Care Financing Administration. Grant No. 18-P-98179/5-01. Ann Arbor, Mich. Department of Medical Care Organization, School of Public Health, The University of Michigan, 1985.

Trieger, S., Galblum, T. W., and Riley, G.: HMO's: Issues and alternatives for Medicare and Medicaid. *Health Care Financing Issues*. HCFA Pub. No. 03107. Office of Research, Demonstrations, and Statistics, Health Care Financing Administration. Washington. U.S. Government Printing Office, Apr. 1981.

Special Report

Impact of the Medicare prospective payment system for hospitals

by Stuart Guterman and Allen Dobson

This article describes some of the available evidence on the impact of the Medicare prospective payment system (PPS) for hospitals during its first year, on hospitals, other payers for inpatient hospital services, other providers of health care, and Medicare beneficiaries. In addition, because the impetus for the enactment of the new system stemmed from concern over the financial status of the Medicare program, the first-year impact of PPS on Medicare program expenditures is also described.

Overview

For several reasons, this article is devoted largely to a description, rather than a rigorous analysis, of PPS and its early impact. At this time, availability of data suitable for a rigorous analysis is limited. For example, we currently have no data on the impact of PPS on most private third-party payers for inpatient hospital care. Also, several data elements currently available in the Medicare Statistical System, such as discharge destination, were not available prior to PPS, and this makes the comparison of pre-PPS and post-PPS behavior difficult in some cases.

The widespread implementation of the new system presents an additional analytic problem, because there is no "control" group suitable for direct comparison with the "experimental" group of PPS hospitals. Furthermore, the gradual way in which PPS is being implemented implies a similarly gradual development of behavioral responses to the new system. Thus, it may be several years before the full impact of PPS is evident.

Moreover, we must take care not to attribute the changes occurring under PPS to the impact of the new system alone. The increasing supply of physicians and other market forces have created conditions that are encouraging many other innovations in the financing and provision of health care. Each of these innovations may make its own contribution to the changes that are being observed. The problem of attribution is one with which health services researchers will continue to contend over time.

Despite these analytic limitations, it is important to present and attempt to analyze the data that are currently available. Regardless of the attribution problem, the documentation of changes occurring under the new system is necessary to the evaluation and improvement of that system. Whether or not PPS is the cause, we need to know whether these changes are desirable or undesirable, and whether they were expected or unexpected consequences of the system of incentives provided by PPS.

A list of some of the desirable and undesirable effects of PPS on the various groups of individuals and institutions subject to its impact is presented in Table 1. To the extent that the desirable effects are observed under the new system, we may feel confident that its objectives are being accomplished, regardless of causality. Similarly, to the extent that the undesirable effects are observed, remedial action may be indicated, again regardless of causality.

In any case, early data on PPS provide a baseline against which to evaluate future observations, and upon which to build a more rigorous analysis of the impact of the new system.

Hospital prospective payment

Background

Prior to the passage of Public Law 98-21, the Social Security Amendments of 1983, hospitals were reimbursed by Medicare on a retrospective cost basis. Under this system, hospitals were paid whatever they spent; there was little incentive to control costs, because higher costs brought about higher levels of reimbursement. Partly as a result of this system of incentives, hospital costs increased at a rate much higher than the overall rate of inflation.

Recognizing the inherently inflationary incentives provided by retrospective cost-based reimbursement, the U.S. Congress legislated several interim changes in the Medicare reimbursement system, as part of Public Law 97-248, the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA). In addition, the Department of Health and Human Services was directed to propose a plan for the prospective payment of hospitals under Medicare that would provide built-in incentives for hospital management efficiency. A report containing such a proposal was delivered to Congress in December 1982, and a prospective payment system (PPS) for Medicare inpatient hospital services was legislated in the spring of 1983. Implementation of PPS began on October 1, 1983.

Objectives

The most important overall objective of the new Medicare prospective payment system is to stem the growth in hospital costs while continuing to ensure the access of beneficiaries to quality health care. To achieve this objective, the system is designed to pay a single flat rate per type of discharge, as determined by the classification of each case into a diagnosis-related group (DRG). These DRG's are used to classify

Table 1

Expected impact of prospective payment system (PPS)

Impact measures	Providers and payers		
	Hospitals	Other payers for inpatient hospital services	Other providers of health care
Economic			
Anticipated benefits	Shorter hospital stays. Fewer unnecessary tests and services. Specialization—economies of scale. Adoption of cost-reducing technology. Improvements in hospital management. Improvements in hospital administrative data systems. Reduction of excess hospital capacity. Vertical integration of health care services.	Rapid diffusion of prospective payment and other innovative payment systems. Cost savings for all payers, with resulting reductions in health insurance premiums.	Increased provision of health care services in non-hospitalsettings. Increased number of discharges from inpatient to cheaper post-hospital care. Hospital acquisition of or contracting with other providers, leading to smoother provision of a continuum of patient care.
Unintended consequences	Increases in unnecessary admissions, readmissions, and transfers. Increases in hospital case-mix, due to changes in coding procedures—"DRG creep." Separate provision of services which previously were considered part of routine inpatient care—"unbundling." Increase in "outlier" cases. Higher expenditures on "pass-through" cost categories—capital, direct medical education, kidney acquisition. Excessive rate of hospital closings.	Potential shifting of cost burden to other payers for hospital services, with resulting increases in health insurance premiums or reductions in benefits. Increase in uncompensated care.	Pressure on physicians to change their practice patterns. Fewer in-hospital physician consultations. Increased frequency of minor surgical procedures. More severely ill patients discharged from inpatient to post-hospital care. Obstacles to providing a continuum of patient care, due to certificate-of-need restrictions, contracting prohibitions, etc.
Quality of care			
Anticipated benefits	Specialization—increase in efficiency and proficiency. Fewer unnecessary tests and services. More selective use of new technology.	Better coordination of health care treatment, payment, and coverage.	More efficient management of patient care. Increased skill levels for post-hospital provider personnel.
Unintended consequences	Increase in unnecessary admissions. Tendency toward premature discharges. Decreases in necessary testing and other ancillary services. Reluctance to adopt quality-enhancing (but expensive in the short run) technology.	Competing incentives to health care providers, depending on the type of coverage.	Fewer in-hospital physician consultations. More severely ill patients discharged from inpatient to post-hospital care.
Access to care			
Anticipated benefits	Availability of more services on a regional level. Shifting of services to more appropriate (and inexpensive) settings.	Reduced health care charges and insurance premiums. Better coordination of health care treatment, payment, and coverage. Increased sponsorship of health maintenance organizations and preferred provider organizations.	Increased availability of services in nonhospital settings.
Unintended consequences	"Dumping" of high-cost cases. Reluctance of hospitals to accept cases in DRG's which are not profitable.	Decrease in coverage for poor patients, due to uncompensated care issue.	Longer backlogs of patients waiting for post-hospital care.

Table 1—Continued

Expected impact of prospective payment system (PPS)

Impact measures	Medicare beneficiaries	Cost control: Hospital expenditures	Cost control: Medicare program expenditures
Economic			
Anticipated benefits	Part A liability limited to legal deductibles and coinsurance.	Budget neutrality in the short run. Slower rate of growth in expenditures for the longer run. More predictable outlays.	Slower rate of growth in program expenditures.
Unintended consequences	Higher out-of-pocket costs, if Part B utilization increases.	Increased growth in "pass-through" costs.	Increased growth in expenditures for substitutes for inpatient care, to the extent that they are not offset by a decline in inpatient hospital expenditures. Increased growth in expenditures for post-hospital care, to the extent that they are not offset by a decline in acute care expenditures.
Quality of care			
Anticipated benefits	Shorter hospital stays. Lower rates of nosocomial infection. Fewer in-hospital complications and deaths. Fewer unnecessary tests and services. Reductions in iatrogenic care. Specialization—increase in efficiency and proficiency.	More efficient provision of hospital care.	More efficient provision of overall health care.
Unintended consequences	Tendency toward premature discharges. Decrease in necessary tests and services. Decrease in necessary physician consultations.	Replacement of quality with financial considerations as the objective of hospitals.	Replacement of quality with financial considerations as the objective of health care providers.
Access to care			
Anticipated benefits	Decrease in overall cost of services provided. Shift in treatment to more appropriate settings. Regional availability of broad range of services.	Reduction in the cost of hospital care. Promotion of the success of efficient hospitals.	Reduction in the total cost of health care. Encouragement of efficiency in the management of health care providers.
Unintended consequences	Selective exclusion of high-cost case types. "Dumping" of "unprofitable" types of patients.	Widespread hospital closings, particularly in underserved or poorer areas.	Reduction in acceptance of Medicare patients.

patients into groups that are clinically coherent and homogeneous with respect to resource use. Such a classification scheme allows for equitable payment across hospitals in that comparable services can be comparably remunerated.

From the perspective of the Medicare program, prospective payment rates have four essential characteristics:

- They are determined in advance and fixed for the fiscal period to which they apply.
- The payment rates for any individual hospital are not automatically determined by the level or pattern of its present or past incurred costs or charges.
- They consititute payment in full for the specific unit of service.
- Each hospital keeps, or loses, the difference between the payment rate and its cost for that unit of care.

These characteristics are intended to provide strong financial incentives for hospitals to control their input costs and resource use.

Prospective payment thus provides a potential solution to the problem of increasing hospital expenditures that threatens the solvency of the Medicare program. The success or failure of prospective payment will be determined by its ability to effect a suitable change in the behavior of those who manage the Nation's hospitals.

Design features

The prospectively determined rate for each DRG covers all Part A (hospital insurance) inpatient operating costs for such items as routine services, ancillary services, and intensive care that are generated by each case in that DRG. Furthermore, hospitals are prohibited from charging beneficiaries more than the statutory deductible and coinsurance amounts. Capital and direct medical education costs, kidney acquisition costs incurred by approved renal transplantation centers, and outpatient costs and Part B (supplementary medical insurance) inpatient costs continue to be reimbursed on a retrospective basis for the time being.

PPS applies to all hospitals participating in the Medicare program, except those hospitals or units specifically excluded, beginning with each hospital's first cost reporting period starting on or after October 1, 1983. To facilitate the transition to PPS, the new methodology is to be implemented over a 3-year phase-in period. During this phase-in period, a declining portion of the total prospective payment rate is to be based on the hospital's own historical costs. This hospital-specific rate is to be combined with a Federal rate, which, in turn, is a combination of the appropriate regional and national rates per discharge.

There are 18 different sets of regional rates, corresponding to urban and rural areas in each of the nine census divisions, and two sets of national rates, one each for urban and rural hospitals. Beginning with the fourth year of PPS (fiscal year 1987), Medicare payment for inpatient operating costs is to be fully determined by the urban or rural national rate per discharge. The transition for a typical hospital with cost reporting period beginning on January 1 is portrayed in Table 2.[1]

Certain types of hospitals and units have been excluded from PPS, pending the development of suitable prospective payment mechanisms. Psychiatric, rehabilitation, children's, and long-term care hospitals are currently in this category, as are distinct-part psychiatric and rehabilitation units of acute care hospitals. In addition, a special exclusion has been provided for alcohol/drug treatment hospitals and units.[2]

Hospitals located outside of the 50 States and the District of Columbia are also currently excluded from PPS. Also, hospitals involved in demonstrations of alternative payment systems have been waived from inclusion in PPS.[3] Certain types of hospitals are accorded special treatment under PPS, including sole community providers, regional referral centers, cancer treatment and research centers, and Christian Science sanitoria.

Table 2

Transition to national prospective payment system rates for a hospital with fiscal year ending December 31

Time period	Hospital-specific	Federal	Regional/National
		Percent	
Oct. 1983-Dec. 1983[1]	—	—	—
Jan. 1984-Sept. 1984	75	25	25/0
Oct. 1984-Dec. 1984	75	25	18.75/6.25
Jan. 1985-Sept. 1985	50	50	37.5/12.5
Oct. 1985-Dec. 1985	50	50	25/25
Jan. 1986-Sept. 1986	25	75	37.5/37.5
Oct. 1986-Dec. 1986	25	75	0/75
Jan. 1987 onward	0	100	0/100

[1]Not subject to prospective payment.

Sole community hospitals are to be paid indefinitely at a rate equal to 75 percent of the hospital-specific rate plus 25 percent of the regional portion of the applicable Federal rate. During the PPS transition period, each such hospital may also receive an additional compensating payment if, because of circumstances beyond its control, it has experienced more than a 5-percent decrease in inpatient cases.

Regional referral centers are paid the applicable rates for urban hospitals in the same geographic region, except that the labor-related portion of the DRG rate is adjusted by the rural wage index (discussed in the following section) applicable to the hospital's location.

Cancer treatment and research hospitals are given the opportunity, during their first cost reporting period under PPS, to opt for reimbursement on a reasonable cost basis, subject to the TEFRA target rate ceiling.

Christian Science sanitoria are paid an amount based on their historical operating costs per discharge.

Prospective payment amounts

Prospective payment rates are determined by three components:

- A standardized payment amount, which represents the average operating cost for a typical Medicare inpatient stay, exclusive of case-mix, area wages, and teaching costs.
- A wage index, which represents the average wage level in each urban or rural area relative to the national average level across all areas.
- A weighting factor for each DRG, which represents the relative costliness of a hospital discharge in that DRG compared with the typical Medicare discharge.

---

[1]The U.S. Congress, in the legislation dealing with the Federal debt ceiling, has temporarily delayed the transition to the third-year blend of hospital-specific and Federal rates. Thus, whatever blend each hospital was subject to on September 30, 1985, is to apply pending resolution of the fiscal year 1986 budget.

[2]Excluded hospitals and units are reimbursed on a reasonable cost basis, subject to the TEFRA target rate ceiling.

[3]Maryland, Massachusetts, New Jersey, and New York were granted waivers from PPS at its outset. Massachusetts' and New York's waivers are due to expire during fiscal year 1986.

In general, the prospective payment rate for a Medicare discharge in a particular hospital would be determined by first adjusting the standardized payment amount by the area wage index for the hospital's area and then multiplying by the weighting factor for the DRG into which the patient has been categorized.

Payments under PPS through fiscal year 1985 were structured to be "budget neutral" with respect to TEFRA; that is, they were to be no more and no less than those projected under the cost-per-case limits and rate-of-increase ceiling provisions contained in the TEFRA legislation.

In addition to the prospective payment rate per discharge, hospitals may receive other payments for Medicare Part A inpatient services. These additional payments may either be in recognition of the existence of certain conditions beyond the scope of PPS, or for "pass-through" costs that cannot yet appropriately be incorporated into the PPS mechanism. Included in the former category are payments for "outlier" cases (atypical cases requiring exceptionally long stays or generating exceptionally high costs compared with the overall distribution of cases in the DRG), Medicare bad debts, and indirect medical education costs. "Pass-through" costs include capital costs, direct medical education costs, and kidney acquisition costs.

Utilization and quality control

Each hospital under PPS is required to have entered into an agreement with a utilization and quality control peer review organization (PRO). The function of the PRO program, which was established under the Peer Review Improvement Act of 1982 (Subtitle C of Public Law 97-248, the Tax Equity and Fiscal Responsibility Act of 1982), is to provide for the review of:

- The validity of diagnostic and procedural information provided by the hospital.
- The completeness, adequacy, and quality of care.
- The appropriateness of admissions and discharges.
- The appropriateness of care for which outlier payments are made.

Thus, the PRO's are established as safeguards of the medical necessity, appropriateness, and quality of care. PRO findings of inappropriate or substandard care may result in denial of payment or, if a pattern of inappropriate or unnecessary care is found, in the termination of the hospital's Medicare provider agreement.

Payment cushions

Several features were incorporated into PPS to ease the transition from retrospective to prospective payment. The inclusion of a hospital-specific portion in the calculation of the prospective payment rates was intended to allow hospitals sufficient time to adjust to the fiscal pressures that they are expected to face under PPS. The inclusion of a regional component allows for variations between areas in practice patterns and other factors that may determine per case costs, but may be beyond the control of the hospital in the short run. The additional payment for indirect medical education, based on the effect of teaching status on per case costs, was set at twice the empirically estimated rate to allow for possible imperfections in the patient classification system that might impose financial hardship on teaching hospitals. Several other allowances were made for types of hospitals that might be vulnerable under the new system.

By providing these "cushions," the designers of PPS have attempted to avoid much of the systemic trauma that might otherwise have been expected under a change as dramatic as that represented by the switch to prospective payment. In an evaluation context, however, these cushions have also made it that much more difficult to observe the full impact of the new system. This impact should thus continue to be monitored over time to more accurately assess the positive and negative effects of PPS.

System implementation

Coverage

By the end of September 1984, a total of 5,405 hospitals (81 percent of all Medicare-participating hospitals) were operating under PPS. This number represents virtually 100 percent of "PPS-eligible" hospitals (that is, short-stay acute care hospitals subject to the new payment system). Because Medicare prospective payment began with the start of the hospital's cost reporting year, rather than the Federal fiscal year, the number of PPS hospitals increased throughout the first year. As shown in Figure 1, only a little more than one-half of all PPS-eligible hospitals were subject to prospective payment by January 1, 1984. There was a jump in PPS coverage in July 1, 1984, when almost one-third of PPS-eligible hospitals came under the new system. Through September 1984, 45 percent of bills from PPS-eligible hospitals processed by the Health Care Financing Administration had been paid under PPS.

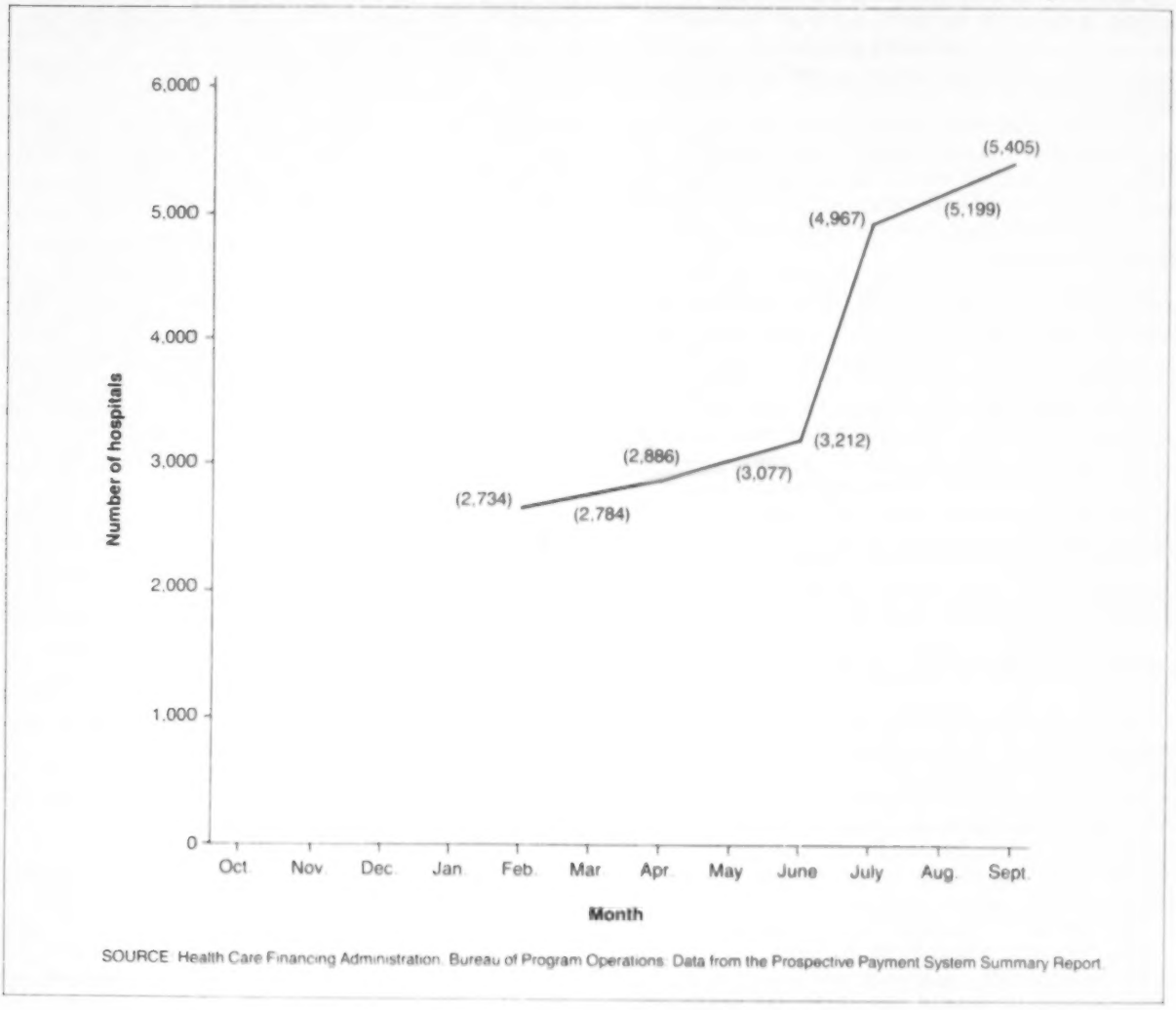
A number of hospitals and distinct-part units of certified hospitals have applied for and received exclusions from prospective payment. As of September 1984, the following were excluded from prospective payment:

- 552 short-stay hospitals in waiver States.
- 439 psychiatric hospitals, and 722 psychiatric units.
- 49 rehabilitation hospitals, and 308 rehabilitation units.
- 25 alcohol/drug hospitals, and 216 alcohol/drug units.
- 83 long-term care hospitals.
- 47 children's hospitals.

In addition to hospitals and units with exclusions from PPS, several other types of hospitals receive

Figure 1

Hospitals covered under the prospective payment system, through end of each month: Fiscal year 1984



SOURCE: Health Care Financing Administration, Bureau of Program Operations: Data from the Prospective Payment System Summary Report.

special consideration under the new system. As of September 1984, these include:

- 304 hospitals that have been determined to be the sole source of inpatient hospital services reasonably available to Medicare hospital insurance (Part A) beneficiaries in a geographic area.
- Six hospitals meeting the requirements for classification as regional referral centers.
- Four hospitals involved extensively in treatment for and research on cancer.
- Six hospitals that previously allowed extensive direct billing under Medicare supplementary medical insurance (Part B).

In addition, Christian Science sanitoria are eligible for special treatment under PPS.

Peer review activity

Contracts establishing 54 PRO's (one for each State, the District of Columbia, Puerto Rico, Guam/American Samoa, and the Virgin Islands) were signed by the legislatively mandated deadline of November 15, 1984. By September 1984, more than 1.1 million PPS admissions had been reviewed by a PRO, or other medical review entity, for medical necessity and appropriateness of treatment and setting.

First-year findings

Overview

The focus of this article is the impact of PPS on hospitals, other payers for inpatient hospital services, other providers of health care, and Medicare beneficiaries, as well as Medicare program expenditures. Although many of the hypothesized effects listed in Table 1 cannot be addressed here, we have attempted to describe the pattern of changes

Table 3

Medicare short-stay hospital admissions, rate per 1,000 hospital insurance enrollees, and percent change: 1978-84

Year	Admissions in thousands	Percent change	Enrollment in thousands as of July 1	Admissions per 1,000 enrollees	Percent change
Calendar year:					
1978	9,444	—	26,777	353	—
1979	9,788	+3.6	27,459	356	+0.8
1980	10,430	+6.6	28,067	372	+4.5
1981	10,858	+4.1	28,590	380	+2.2
Fiscal year:					
1982	11,220	+3.3	29,069	386	+1.6
1983	11,696	+4.2	29,587	395	+2.3
1984	[1]11,495	−1.7	[2]30,141	381	−3.5

[1]Admissions data for fiscal year 1984, are adjusted to account for processing lags.
[2]Enrollment figures for July 1, 1984, as projected by the Bureau of Data Management and Strategy.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System.

occurring under PPS. This pattern, it is hoped, will enable us to form some general conclusions about the response of the health care sector to the new payment system.

Impact on hospitals

When PPS was enacted, it was anticipated that the new system, in paying on a per case rather than on the previous per diem basis, would provide an incentive for hospitals to increase the volume of admissions. Since each extra admission generates additional revenue for the hospital, it was thought that financial considerations would encourage the admission of any case for which the cost of treatment is expected to be less than the relevant DRG payment rate. In addition, with the expected decrease in average length of stay, an incentive would exist to fill the rising number of empty beds.

The annual number of Medicare short-stay hospital admissions for the period 1978-84, and the rate of admissions per 1,000 Part A enrollees are shown in Table 3. Medicare admissions steadily rose during the entire period prior to the implementation of PPS, with the annual increase never falling below 3.3 percent. The figures for fiscal year 1984, however, indicate a decrease in admissions of 1.7 percent, which is quite contrary to *a priori* expectations, as well as previous experience. The fiscal year 1984 decrease in admissions per 1,000 enrollees was estimated at 3.5 percent. It appears that the increase in admissions that was anticipated in response to PPS has not materialized.

The reason for this reversal in the historical trend toward increasing admissions is not clear at this time. However, it may reflect the changing role of the hospital in our health care system, with an increasing emphasis on ambulatory care, as rising inpatient costs make it desirable and improvements in technology make it feasible to provide more health care in alternative settings.

The most commonly accepted expectation about PPS at the time of its inception was that it would result in shorter stays for Medicare patients. Reduced length of stay was, in fact, to be one of the major vehicles through which hospital costs were to be controlled under PPS.

Table 4

Average length of stay for Medicare beneficiaries in short-stay hospitals and percent change: 1967-84

Year	Average length of stay[1]	Percent change
Calendar year:		
1967	13.8	—
1968	13.8	0.0
1969	13.5	−2.2
1970	13.0	−3.8
1971	12.5	−3.9
1972	12.1	−3.2
1973	11.7	−3.3
1974	11.5	−1.7
1975	11.2	−2.6
1976	11.1	−0.9
1977	10.9	−1.8
1978	10.8	−0.9
1979	10.7	−0.9
1980	10.6	−0.9
Fiscal year:		
1981	10.5	−0.9
1982	10.3	−1.9
1983	10.0	−2.9
1984	[2]9.1	−9.0

[1]Data for calendar years 1967-80 refer to aged beneficiaries only. The omission of other Medicare beneficiaries may result in an overstatement of approximately 0.1 days in annual length of stay for these years in this table.
[2]Based on records processed through September 1984.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System.

Annual data on average length of stay for Medicare beneficiaries for the period 1967-84 are presented in Table 4. Length of stay had been steadily declining during the 15-year period prior to PPS, and the decline during fiscal year 1983 (when TEFRA provisions were in effect) was the largest in 10 years. The drop in length of stay during the first year of PPS, however, indicates a substantial acceleration of this trend. The largest previous annual decline in the

history of the Medicare program was less than 4 percent, whereas length of stay dropped by 9 percent in fiscal year 1984. In absolute terms, length of stay declined by almost 1 full day in fiscal year 1984, compared with the largest pre-PPS drop of only one-half day.

Figure 2 graphically depicts the downward trend in Medicare length of stay. The actual length of stay for fiscal year 1984 (9.1 days) was substantially lower than the length of stay that would have been projected from previous experience (9.6 days). This finding would appear to confirm *a priori* expectations as to the impact of PPS.

In a study by the Rand Corporation (Carter and Ginsburg, 1985), it was found that the Medicare Case-Mix Index (CMI) for PPS cases in fiscal year 1984 was 8.4 percent higher than the CMI in 1981, exceeding the estimates that had been made when the new system was implemented. This CMI increase was decomposed into the components shown in Table 5. The Rand study found that most of the CMI increase was accounted for by changes in documentation and coding, including improvements in data collection by the Medicare program. Medical practice changes were also found to have accounted for a substantial portion of the increase.

Other dramatic changes in hospital behavior are being observed under PPS. With decreases in both admissions and length of stay, hospitals are experiencing the lowest occupancy rates in memory. For fiscal year 1984, the American Hospital Association (1984b) reported an average occupancy rate of 67.7 percent, down from 73.7 percent for the previous year. Not surprisingly, hospital staffing levels also dropped 2.0 percent.

At the same time, hospitals have reported sharp increases in profits. Surplus revenue (the difference between income and expenses associated with treating patients) for all U.S. hospitals more than doubled during 1984, with for-profit hospitals reporting a 44-percent increase in net income (Waldholz, 1985). In addition, an analysis of a sample of 1984 Medicare Cost Reports by the Inspector General of the Department of Health and Human Services indicates that PPS payments were an average of 14 percent greater than operating costs for Medicare patients (Kusserow, 1985). This increase in profitability, at a time when occupancy rates are falling, indicates that the Nation's hospitals are responding rapidly to the changing environment in the health care sector. Although some portion of this revenue surplus may be transitory, disappearing as the PPS payment "cushions" previously described are eliminated and as fiscal pressure from other third-party payers increases, it is a clear indication of the extent to which most hospitals have control over the costs that they incur.[4]

[4]Although hospitals are generally more profitable, the American Hospital Association reports that 18 percent of all hospitals experienced revenue deficits during 1984. Many of these hospitals are small rural facilities, without much flexibility in planning their budgets, and urban public hospitals, which treat a large proportion of uninsured patients.

Impact on other payers

The Medicare program accounts for some 27 percent of all expenditures on hospital care in the United States, clearly establishing Medicare as the largest single consumer of hospital services (Gibson, Waldo, and Levit, 1983). Given the dominant role played by Medicare, and the dramatic change in the way that Medicare pays for hospital services under PPS, it would not be unreasonable to expect that the entire hospital payment environment might be altered by the new system. Among those most likely to be directly affected by such a change are those who pay the bulk of the remaining portion of the Nation's hospital bill, the most prominent of these being the State Medicaid programs (on the public side) and the Blue Cross/Blue Shield plans (on the private side).

With the enactment of Public Law 97-335, the Omnibus Budget Reconciliation Act of 1981 (OBRA), the authority of the States to modify their methods of hospital payment was expanded. This authority relieved the States of the requirement that their Medicaid programs follow Medicare's retrospective reasonable cost-based reimbursement principles, and enabled them to tailor their programs more specifically to their own policy needs. Following the enactment of OBRA, several States began experimenting with prospective payment and other alternatives to retrospective reimbursement.[5]

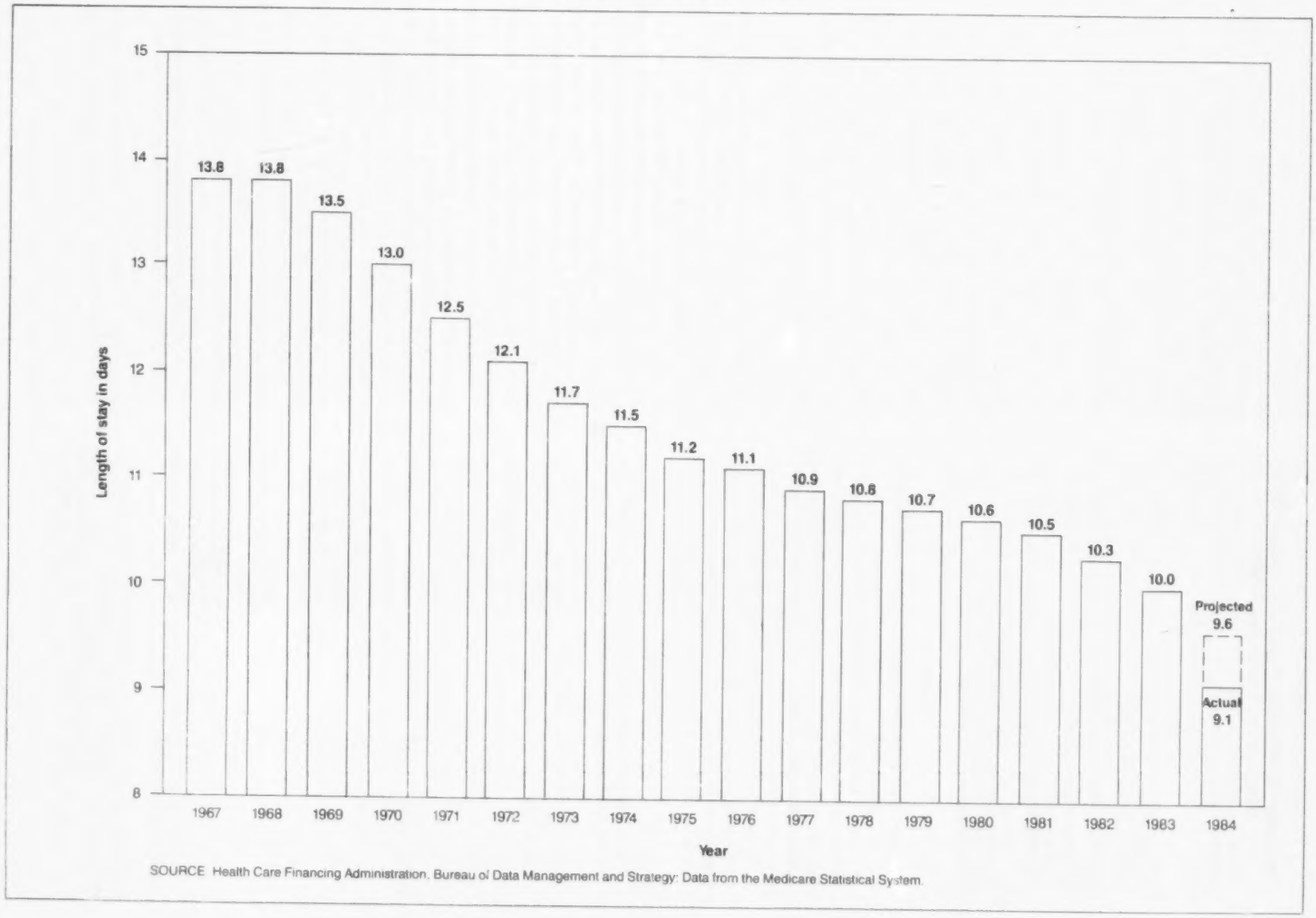
With the implementation of PPS, States' activities in modifying their hospital payment methodologies have accelerated. A study of the 54 State and territorial Medicaid programs found that, as of October 1984, 33 States and one territory had some form of prospective payment methodology in effect for hospital inpatient services (Bill et al., 1984). As shown in Table 6, only four of these States—New Jersey, Ohio, Pennsylvania, and Utah—had followed Medicare in adopting DRG's as the basis of payment.[6] However, Michigan, South Dakota, and Washington had developed DRG-based systems that were about to be implemented, and other States reportedly considering the implementation of such systems included Connecticut, Indiana, Minnesota, North Carolina, Oregon, and Wyoming.

Data on recent trends in Medicaid utilization and expenditures from a study at Brandeis University (Singer, 1985), indicate decreases in the number of Medicaid users of inpatient hospital services and in the rate of growth of Medicaid payments for inpatient hospital services. These trends are consistent with trends in Medicare utilization and expenditures presented in this article, and suggest that the changes

[5]Several statewide demonstrations of alternatives to the retrospective reasonable cost-based payment systems had been authorized during the years prior to OBRA, under the authority of the Social Security Amendments of 1972. In fact, experience with these State programs provided important input toward the development of PPS.

[6]The New Jersey system preceded the Medicare PPS. In addition, Georgia attempted a DRG-based system during the early 1980's, but abandoned it after 2 years.

Figure 2
Medicare length of stay: 1967-84



SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System.

Table 5

Increase[1] in Medicare Case-Mix Index, by component: Fiscal year 1984

Component	Percent
Total[2]	8.4
Medical practice changes	2.1
Pre-PPS[3] trend	1.4
Shifts to outpatient settings	0.7
Aging of the beneficiary population	0.0
Coding practice changes	6.2
PPS-induced[3]	2.8
Improvements in data quality	3.3

[1]Since 1981.
[2]These percentages are multiplicative, rather than additive, so the components do not necessarily add up to the total.
[3]Prospective payment system.

Table 6

Prospective payment-type methodologies in State and territorial Medicaid programs: October 1984

Type	States/Territories
Diagnosis-related-group-based	New Jersey
	Ohio
	Pennsylvania
	Utah
Per diem	Alabama
	California
	Colorado
	Illinois
	Iowa
	Kansas
	Kentucky
	Maryland
	Mississippi
	Missouri
	Nebraska
	New York
	North Carolina
	Oklahoma
	Tennessee
	Virginia
	Guam
Budget review	Alaska
	Florida
	Maine
	Massachusetts
	Michigan
	Rhode Island
	Washington
Other	Arizona
	Georgia
	Idaho
	Montana
	Nevada
	Oregon

SOURCE: (Bell et al., 1984).

occurring in the health care sector may be broader than can be accounted for by PPS alone.

Blue Cross was begun in 1929 as a prepayment plan for hospital care for some 1,000 employees of Baylor University. The first Blue Shield plan, designed as a complementary prepayment plan for physicians' services, was organized 10 years later. From these modest beginnings, the Blue Cross and Blue Shield system has grown to 75 autonomous plans in the United States, Puerto Rico, Canada, and Jamaica. By 1982, nearly 86 million people had hospital insurance protection under Blue Cross and Blue Shield plans (Health Insurance Association of America, 1983).

Collectively, these plans comprise a large share of the hospital services market. However, because each plan is an independent organization, no standard subscriber contract or universal payment methodology can be attributed to Blue Cross/Blue Shield. Historically (prior to the enactment of Medicare prospective payment), however, the majority of these plans have used cost-based reimbursement methods, with the remainder using charge-based systems.

With the implementation of PPS, some Blue Cross and Blue Shield plans have adopted prospective pricing systems that use DRG's, but the American Hospital Association (1984a) reported that "there is no 'big push' by the plans toward the use of this particular mechanism." In addition, some plans have adopted prospective pricing, but without DRG's, and others utilize DRG's, but not within a prospective pricing system. The American Hospital Association also noted a recent trend toward the development of health maintenance organizations (HMO's) and preferred provider organizations (PPO's) by Blue Cross and Blue Shield plans.

Plans in Arizona, Kansas, Nebraska, and Oklahoma presently use some form of DRG-based payment, and the Florida and Michigan plans have pilot programs using DRG's. New Jersey has an all-payer DRG-based system. Several other plans use some form of prospective pricing, including Arizona, Connecticut, Michigan, Minnesota, Rhode Island, and Iowa. The use of prospective pricing in Massachusetts and New York is mandated by State law.

By the end of 1984, Blue Cross and Blue Shield plans were administering 20 PPO's, and the number was expected to grow to 44 by the end of 1985 (Blue Cross and Blue Shield Association, 1985). In addition, a total of 40 Blue Cross and Blue Shield plans were operating 57 HMO's at the end of 1983, with more than 1.5 million members. By the end of 1984, the number of these HMO's had increased to 62, with a membership of 2 million.

Preliminary results from one study (Scheffler and Gibbs, 1985) show that, since October 1983, hospital admission rates per 1,000 Blue Cross/Blue Shield members and days per 1,000 members have declined at rates exceeding those for Medicare beneficiaries. There has also been a decline in average length of stay for Blue Cross/Blue Shield members, but that decline has been less rapid than that for Medicare beneficiaries. The overall financial impact has been to reduce Blue Cross/Blue Shield hospital inpatient payments. The causes of these changes have not been

ascertained, but several factors are being considered in the study, including:

- Cost and utilization controls being used by Blue Cross/Blue Shield plans, as well as alternate delivery systems such as Blue Cross/Blue Shield PPO's and HMO's.
- Changes in payment systems being used by the States.
- The impact of PPS.
- Other changes in the overall structure of the health care system.

Although the organizational response of other third-party payers for hospital services has been mixed, with the Medicaid programs showing a tendency to move toward prospective payment and the Blue Cross and Blue Shield plans investigating other cost-containment strategies, the overall picture that is presented is the same. A dramatic change is occurring within the health care sector, and new payment strategies are at the center of that change. The interactions among these strategies, and their effects on the health care sector, will continue to be a topic of study in the coming years.

Impact on other providers

As hospitals respond to the system of incentives created by PPS, their decisions regarding the treatment of Medicare patients may have an impact on other providers of health care, particularly physicians and nursing homes.

Currently, physician payment is based on Medicare customary and prevailing charge schedules, with increases in Medicare payment rates limited by the Medicare Economic Index. Therefore, the incentives provided by prospective payment do not apply directly to physicians. However, some preliminary results from a pretest for HCFA's Physicians' Practice Costs and Incomes Survey indicate that some effect is being felt by physicians. Responses of the pretest Survey sample, which included some 200 physicians in five States, to a question on recent pressures by hospital management to change their patient management behavior are presented in Table 7. These results are consistent with the expectation that, under prospective payment, hospitals would encourage physicians to reduce ancillary services, shorten hospital stays, and increase outpatient testing. An increased tendency to treat patients in nonhospital settings might also help to explain the surprising decrease in admissions under PPS.

SNF's are currently reimbursed for routine costs per Medicare patient day, subject to an upper reimbursement limit, with hospital-based SNF's having higher limits than do freestanding SNF's. With hospitals seeking to reduce lengths of stay for Medicare patients under PPS, an increase is anticipated in the rate of transfer of Medicare cases to long-term care providers. Data on SNF admission notices show a slight acceleration in the projected rate of increase in SNF admissions during fiscal year 1984. Although the rate of increase in SNF admission notices processed by HCFA for the previous two fiscal years was 4.7 percent, the projected rate of increase for fiscal year 1984 was 5.7 percent.

These preliminary indications appear to reveal a tendency under PPS to increase the care provided to patients in other than inpatient settings. To the extent that this tendency reflects an improvement in the coordination of health care provision among providers in ambulatory, inpatient, and long-term care settings, PPS may be seen as encouraging overall efficiency in the health care sector. To the extent that it represents a reluctance on the part of hospitals to offer patients the amount of care that they require, PPS may be seen as an impediment to necessary health care. To date, there is no systematic evidence that access to needed care has been hampered by PPS. This issue, however, will continue to be monitored as better data become available.

Impact on Medicare beneficiaries

Among the major concerns under PPS is the continued access of Medicare beneficiaries to appropriate health care, and the maintenance of the quality of care provided to these beneficiaries. The issues of access and quality are particularly important to certain groups within the Medicare population, such as the disabled (especially the aged disabled), renal patients, the very old, and the aged poor, each of whom have special health and socioeconomic

Table 7

Response to question from Physician's Practice Costs and Incomes Survey pilot test: 1984

Question: Since this time last year, has the hospital administrator, chief of medicine, or any other medical staff suggested that you . . .

Type of physician and suggestion	Number		Percent yes
	Yes	No	
All physicians			
Increase admissions	21	137	13
Decrease Medicare admissions	5	151	3
Increase Medicare admissions	2	154	1
Concentrate on admitting certain diagnosis-related groups	3	155	2
Reduce ancillaries	25	133	16
Shorten length of stay	58	99	37
Radiologists, anesthesiologists, and pathologists			
Reduce ancillaries	3	29	9
Constrain expensive diagnostics	4	28	13
Encourage outpatient testing	16	16	50

SOURCE: National Opinion Research Center: *Physicians' Practice Costs and Incomes Survey: Final Pretest Report.* HCFA Contract No. 500-83-0025. Prepared for Health Care Financing Administration, Chicago, Ill. Sept. 1984.

characteristics that make them particularly vulnerable to the incentives provided by the new payment system. Because these groups are likely to require more intensive (and thus more expensive) care for a given type of inpatient episode, hospitals may tend to view them as potential money losers under prospective payment.

On the other hand, certain incentives under PPS may serve to encourage improvements in access and quality. Because improved management is encouraged, the effectiveness of health care may be enhanced. Greater integration of health care delivery under PPS may result in the provision of more appropriate and effective care. Hospitals are also encouraged to specialize in services and procedures that they provide most efficiently, which may improve outcomes in certain cases, as found in several studies (Luft, 1980; Flood, Scott, and Ewy, 1984a and 1984b; Lubitz, Riley, and Newton, 1985). In addition, the incentive to eliminate unnecessary services should result in an improvement in the quality of care. Moreover, shorter hospital stays should reduce the risk of nosocomial infection and other iatrogenic events to which the elderly are especially vulnerable.

The major provision for the monitoring of access and quality under prospective payment is the PRO program. This program represents an effort by HCFA to intensify the review of Medicare claims to ensure that the care rendered by the hospital is necessary, appropriate, and of acceptable quality. Each PRO is required to be accountable for three admission and five quality objectives (with certain exceptions in waiver States and exempt areas).

The admission objective areas are:

- Shifting of inappropriate inpatient admissions to outpatient settings.
- Reduction of unnecessary admissions and procedures.
- Reduction of unnecessary admissions by specific hospitals and physicians.

The quality objective areas are:

- Reduction of unnecessary admissions.
- Reduction of mortality rates for specific "problem" procedures.
- Reduction of unnecessary invasive procedures.
- Assurance that patients will receive complete treatment and adequate ancillary services.
- Reduction of post-procedural complications.

As stated earlier, contracts establishing 54 PRO's were signed by November 15, 1984.

In addition to the PRO program, HCFA's survey and certification program is designed to ensure that hospitals and skilled nursing facilities (SNF's) are in compliance with the health and safety requirements of the conditions of participation in the Medicare program. Of the approximately 6,800 Medicare participating hospitals, the individual States survey about 1,500 for compliance with the Medicare requirements. The remaining hospitals, accredited by the Joint Commission on the Accreditation of Hospitals (JCAH), are, by law, deemed in compliance by virtue of their JCAH accreditation.

In anticipation of the increased need for monitoring the provision of health care under PPS, the conditions of participation are being revised to place more emphasis on outcome-oriented criteria. In particular, a new quality assurance condition has been proposed that would require hospitals to have an effective program to identify and resolve problems that affect the quality of patient care. In addition, a number of previously existing requirements that specify procedures for ensuring quality have been incorporated into the proposed quality assurance condition, in the belief that a focused requirement will be a better vehicle through which to address the quality of care.

The Office of the Inspector General (OIG) of the Department of Health and Human Services is also working to monitor access and quality under the PPS by:

- Identifying providers who may be engaged in fraudulent or abusive practices.
- Evaluating the effects of reimbursement and coverage policy on selected health care services.
- Measuring HCFA's effectiveness in monitoring its contractors (such as the PRO's) in assuring appropriate payments under its programs.

Additional activities may be undertaken by OIG as new priorities arise.

A number of studies are currently under way for the purpose of evaluating the impact of PPS on access and quality. These studies are to focus on indicators of access and quality such as the availability of services by hospital, utilization patterns of Medicare beneficiaries, in-hospital and post-discharge mortality rates, rehospitalization rates, transfers between hospitals, and discharges to post-hospital care. In addition, several studies are to focus on methods for measuring the quality of inpatient care.

At present, there are no objective data indicating that access to care has diminished or that quality of care has declined as a result of the implementation of PPS.

Within HCFA's Office of Research and Demonstrations, data on trends in admissions, length of stay, and total days of hospital care by beneficiary group have been examined, and it was found that the general decreases in those indicators observed in 1984 do not appear to be concentrated among any one group of beneficiaries (Eggers, 1985). Although total days of hospital care per 1,000 beneficiaries decreased in fiscal year 1984 after remaining relatively constant in recent years, this decrease was spread evenly across beneficiary groups (Table 8). These analyses provide no indication of an access problem for particular patient groups.

As previously discussed, there is evidence of some increase in the rate of hospital discharges to post-hospital care, but the impact of this increase on access or quality has not yet been ascertained. The changes that have been observed during the first year of PPS imply that hospitals are adjusting to the new system, and that this adjustment has been fairly smooth. The careful and systematic assessment of the impact of

Table 8

Total days of hospital care per 1,000 Medicare beneficiaries and annual percent change, by sex, race, and age: 1980-84

Sex, race, and age	Year[1]					Annual percent change 1980-83	Annualized percent change 1983-84[2]
	1980	1981	1982	1983	1984		
	Days of care per 1,000 beneficiaries						
Total	3,805	3,734	3,847	3,922	3,373	-0.2	-14.2
Sex							
Male	3,985	3,907	3,982	3,936	3,515	-0.4	-14.0
Female	3,682	3,619	3,757	3,683	3,277	0.0	-14.4
Race							
White	3,819	3,745	3,846	3,782	3,373	-0.3	-14.2
All other	4,895	4,840	5,127	5,063	4,501	+1.1	-14.5
Age							
65-69 years	2,692	2,637	2,652	2,607	2,287	-1.1	-16.0
70-74 years	3,407	3,335	3,433	3,369	3,008	-0.4	-14.0
75-79 years	4,336	4,245	4,384	4,321	3,851	-0.1	-14.2
80-84 years	5,216	5,171	5,327	5,209	4,643	0.0	-14.2
85 years or over	5,914	5,757	6,012	6,919	5,320	0.0	-14.3

[1] Data are for calendar years 1980-83 and fiscal year 1984.
[2] Because calendar year 1983 ended in December 1983 and fiscal year 1984 ended in September 1984, the percent change between the figures for these two periods was adjusted to reflect the rate of change on an annual basis.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy. Data from the Medicare provider analysis and review files.

Table 9

Estimated Medicare benefits payments and percent change, by type of provider: Fiscal years 1967-84

Fiscal year	Inpatient hospital		Outpatient hospital[1]		Physician[2]		Skilled nursing		Home health[3]	
	Amount in millions	Percent change	Amount in millions	Percent change	Amount in millions	Percent change	Amount in millions	Percent change	Amount in millions	Percent change
1967	$2,393	—	$15	—	$629	—	$97	—	$21	—
1968	3,348	+39.9	40	+166.7	1,304	+107.3	344	+254.6	60	+185.7
1969	4,239	+26.6	67	+ 67.5	1,516	+ 16.3	367	+ 6.7	77	+ 28.3
1970	4,452	+ 5.0	93	+ 38.8	1,814	+ 19.7	298	− 18.8	89	+ 15.6
1971	5,182	+16.4	137	+ 47.3	1,831	+ 0.9	214	− 28.2	76	− 14.6
1972	5,887	+13.6	174	+ 27.0	1,996	+ 9.0	174	− 18.7	84	+ 10.5
1973	6,412	+ 8.9	175	+ 0.6	2,118	+ 6.1	179	+ 2.9	100	+ 19.0
1974	7,513	+17.2	319	+ 82.3	2,426	+ 14.5	214	+ 19.6	138	+ 38.0
1975	9,947	+32.4	509	+ 59.6	3,065	+ 26.3	273	+ 27.6	228	+ 65.2
1976	11,742	+18.0	717	+ 40.9	3,690	+ 20.4	308	+ 12.8	339	+ 48.7
1977	14,265	+21.5	953	+ 32.9	4,599	+ 24.6	351	+ 14.0	441	+ 30.1
1978	16,684	+17.0	1,184	+ 24.2	5,327	+ 15.8	354	+ 0.9	543	+ 23.1
1979	19,067	+14.3	1,445	+ 22.0	6,397	+ 20.1	364	+ 2.8	647	+ 19.2
1980	22,842	+19.8	1,809	+ 25.2	7,814	+ 22.2	387	+ 6.3	772	+ 19.3
1981	27,744	+21.5	2,215	+ 22.4	9,513	+ 21.7	424	+ 9.6	959	+ 24.2
1982	32,729	+18.0	2,916	+ 31.6	11,392	+ 19.8	454	+ 7.1	1,176	+ 22.6
1983	36,083	+10.2	3,342	+ 14.6	13,498	+ 18.5	500	+ 10.1	1,545	+ 31.4
1984	39,050	+ 8.2	3,739	+ 11.9	14,936	+ 10.7	545	+ 9.0	1,898	+ 22.8

[1] Includes payments for routine maintenance dialysis treatments since fiscal year 1974.
[2] Includes payments for durable medical equipment, ambulance, and several other nonphysician services covered under Medicare supplementary medical insurance.
[3] Includes benefits paid under Medicare hospital insurance and supplementary medical insurance.

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of Medicare Cost Estimates.

Table 10

Average annual rates of increase in estimated Medicare benefit payments, by type of provider: Fiscal years 1973-84

Type of provider	1973-82		1982-83		1983-84	
	Actual	Real[1]	Actual	Real[1]	Actual	Real[1]
			Percent			
Inpatient hospital	+19.9	+10.0	+10.2	+ 6.8	+ 8.2	+ 3.8
Outpatient hospital	+36.7	+25.5	+14.6	+11.0	+11.9	+ 7.3
Physician	+18.8	+ 8.9	+18.5	+14.8	+10.7	+ 6.2
Skilled nursing	+ 8.7	− 0.3	+10.1	+ 7.0	+ 9.0	+ 4.2
Home health	+26.9	+16.4	+31.4	+27.3	+22.8	+17.8

[1]Deflated by the Consumer Price Index for "all items."

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Division of Medicare Cost Estimates.

PPS on access and quality is and will continue to be a crucial aspect of the evaluation of the new payment system.

Impact on Medicare expenditures

The principal motivation of Congress in enacting prospective payment for Medicare inpatient hospital services was to constrain the depletion of the Medicare Trust Funds, therefore, a primary indicator of the success or failure of PPS would be its effect on the volume and rate of growth in Medicare program expenditures.

The growth of Medicare benefit payments by type of provider over the history of the program is shown in Table 9. Inpatient hospital payments have risen from about $2.4 billion in fiscal year 1967 to more than $39 billion (estimated) in fiscal year 1984. The apparent effect of recent efforts to control the increase in Medicare hospital expenditures is shown in Table 10. From fiscal year 1974 (after temporary wage and price controls were removed) through fiscal year 1982 (the last year prior to the imposition of TEFRA restrictions), Medicare inpatient hospital benefit payments increased at an annual rate of 19.9 percent (10 percent in real terms), never falling below 14.3 percent in any given year. Under TEFRA (during fiscal year 1983), this rate of increase was only 10.2 percent (6.8 percent in real terms), lower than at any time in the previous 10 years. Furthermore, the estimated rate of increase under PPS (during fiscal year 1984) was lower still, at 8.2 percent (3.8 percent in real terms), among the smallest percent increases in the program's history.

The historical pattern of Medicare benefit payments for outpatient hospital services[7] represented in Table 9 shows that outpatient hospital payments grew from $319 million in fiscal year 1974 to an estimated $3.7 billion 10 years later, with the annual rate of increase never falling below 14.6 percent from fiscal year 1974 through fiscal year 1983. In fiscal year 1984, however, estimated outpatient hospital payments grew by less than 12 percent, the smallest percentage increase since fiscal year 1973. As shown in Table 10, the pre-TEFRA annual rate of increase in outpatient hospital payments was substantially higher than that under TEFRA and PPS. In fact, in both nominal and real terms, the most recent increase represents the smallest percentage change for any 2-year period in the program's history. Despite this fact, however, estimated Medicare outpatient hospital benefit payments outgrew inpatient hospital payments for the eleventh consecutive year in fiscal year 1984.

As shown in Table 9, Medicare benefit payments for physician services[8] have increased from $629 million in fiscal year 1967 to an estimated $14.9 billion in fiscal year 1984, an increase of almost 2,300 percent. Even in real terms, physician payments are almost eight times as high now as they were in fiscal year 1967. From fiscal year 1975 through fiscal year 1983, the annual increase in this component of Medicare payments was never smaller than 15 percent. Although the estimated increase of 10.7 percent in fiscal year 1984 was the smallest in 11 years, it was also greater than the increase in the inpatient hospital component for the sixth consecutive year. A change in the pattern of growth in Medicare payments for physician services is apparently reflected in Table 10, but the extent to which this is a result of the physician payment "freeze" that was in effect for part of the PPS year is unclear. Effective July 1, 1984, a temporary "freeze" was put on Medicare physician services payment rates, under the provisions of Public Law 98-369. This freeze would have had the effect of dampening the increase in Medicare benefit payments for physician services.

As previously mentioned, one of the anticipated effects of PPS incentives was that they would encourage hospitals to discharge patients to post-hospital care more frequently and at an earlier stage of recuperation. It would then be expected that skilled

[7]Since fiscal year 1973, expenditures in the outpatient services category, as estimated by HCFA's Office of the Actuary, includes benefits for routine maintenance dialysis treatments for ESRD patients. In fiscal year 1983, these benefits accounted for more than 40 percent of all Medicare outpatient services payments. Constraints arising from the revised payment method for ESRD services may thus have had a strong effect in limiting the overall growth of this category.

[8]Physician services payment, as estimated by HCFA's Office of the Actuary, includes payments for durable medical equipment, ambulance services, medical supplies, and other eligible services associated with the provision of physician services.

nursing payments would rise under PPS. As shown in Table 9, the growth in skilled nursing payments has accelerated somewhat in the past 2 years, at an average real rate of 5.6 percent, compared with a decrease in real terms over the pre-TEFRA period. This rate of increase, however, is only slightly greater than that for inpatient hospital payments.

Medicare payments for home health services have increased rapidly in recent years (Table 9). Since fiscal year 1973, the annual increase in this component of Medicare payments has never been below 19 percent. In fact, except for the period of temporary wage and price controls from 1971 to 1974, the annual growth in home health payments has never been less than 15 percent. The growth of home health payments may be contrasted with that of skilled nursing payments. Although the amount of home health payments was barely one-sixth that of skilled nursing payments in fiscal year 1968, 16 years later, home health payments were almost four times as high as skilled nursing payments. One factor in the growth of Medicare home health payments was the Omnibus Reconciliation Act of 1980 (Public Law 96-499). This Act liberalized home health benefits under Medicare by providing for the coverage of an unlimited number of home health visits (as opposed to the previous limit of 100 visits during a benefit period) and eliminating the 3-day prior hospitalization requirement as a condition for the receipt of services.

As illustrated in Table 10, the growth rate of home health payments seems to have continued at the pre-TEFRA level or higher. Home health payments increased at a somewhat higher rate than did inpatient hospital payments during the pre-TEFRA period. Under PPS, the estimated growth has accelerated to a rate about 4.5 times as high as that for inpatient hospital payments and more than twice as high as that for any other major benefit category. These figures seem consistent with expectations about the growth of post-hospital care under PPS.

Total Medicare benefit payments increased from $3.2 billion in fiscal year 1967 to $49.1 billion in fiscal year 1982, as shown in Table 11. This represents an increase of 20 percent per year over that time period, or 11.8 percent per year in real terms. Medicare benefit payments per beneficiary also grew steadily during the pre-TEFRA period, from $162 in fiscal year 1967 to $1,666 in fiscal year 1982. This represents an average annual increase of 16.8 percent, or 8.8 percent in real terms.

More recently, the growth in Medicare benefit payments appears to be more moderate, according to the figures presented in Table 12. Benefit payments under both Medicare hospital insurance (HI) and supplementary medical insurance (SMI) grew at annual rates of more than 20 percent during the pre-TEFRA period. However, the growth rate of HI benefit payments was sharply reduced under TEFRA, and both HI and SMI benefit payments grew at about half of their pre-TEFRA rates during the first year of PPS. As a result, total Medicare benefit payments per beneficiary grew by only 3.4 percent in real terms during fiscal year 1984.

Conclusions

The data presented in this article are used to describe several aspects of the performance of the health care sector during the first year of the Medicare prospective payment system for hospitals.

Table 11

Total Medicare benefit payments, beneficiaries, and payments per beneficiary: Fiscal years 1967-84

Fiscal year	Total benefit payments in millions		Medicare beneficiaries in thousands	Payments per beneficiary	
	Actual	Real[1]		Actual	Real[1]
1967	$3,172	$3,172	19,521	$162	$162
1968	5,126	4,919	19,821	259	248
1969	6,299	5,737	20,103	313	285
1970	6,783	5,832	20,491	331	285
1971	7,477	6,164	20,915	357	295
1972	8,363	6,674	21,332	392	313
1973	9,039	6,791	23,545	384	288
1974	10,680	7,231	24,201	441	299
1975	14,118	8,758	24,959	566	351
1976	16,939	9,935	25,663	660	387
1977	20,773	11,445	26,458	785	433
1978	24,263	12,417	27,164	893	457
1979	28,150	12,948	27,859	1,010	465
1980	33,934	13,750	28,478	1,192	483
1981	41,252	15,144	29,010	1,422	522
1982	49,149	17,001	29,494	1,666	576
1983	55,589	18,629	30,026	1,851	620
1984	60,949	19,598	30,593	1,992	641

[1] 1967 dollars.

SOURCES: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System; Office of the Actuary: Data from the Division of Medicare Cost Estimates.

Table 12

Average annual rates of increase in Medicare benefit payments, by type of payment: Fiscal years 1973-84

Type of payment	1973-82		1982-83		1983-84	
	Actual	Real[1]	Actual	Real[1]	Actual	Real[1]
	Percent					
Total	+20.7	+10.7	+13.1	+ 9.6	+ 9.6	+5.2
Hospital insurance	+20.0	+10.1	+10.9	+ 7.5	+ 8.9	+4.4
Supplementary medical insurance	+22.5	+12.3	+18.1	+14.4	+11.4	+6.8
Per beneficiary	+17.7	+ 8.0	+11.1	+ 7.6	+ 7.6	+3.4

[1] Deflated by the Consumer Price Index for "all items."

SOURCES: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System; Office of the Actuary: Data from the Division of Medicare Cost Estimates.

Although PPS directly affects only hospital behavior, it seems likely that the impact of the new system will be felt by many other groups of payers, providers, and consumers of health care. Moreover, although the major thrust of prospective payment is economic in nature, PPS may have an effect on access to health care and its quality as well.

It is difficult to measure the impact of PPS during its first year or to determine what effects are attributable to the new system. The availability of data for this type of analysis is limited. In addition, the gradual implementation of PPS makes it likely that the full impact will not be felt until future years, when prospective payment has been in place for awhile and its provisions and incentives are fully effective. Also, the dynamic nature of the health care sector will complicate any attempts to trace observed changes to any specific policy initiative.

Nonetheless, however valid the reservations about using early data to draw conclusions about the impact of PPS, it is important to at least attempt some tentative observations about the changes occurring during the first year of prospective payment. Whether or not the observed changes can be conclusively attributed to PPS, these observations are necessary to indicate whether progress is being made toward accomplishing the objectives of the new system.

The findings reported here lead to several observations about developments in the health care sector during the first year of PPS. Perhaps the most important of these developments is that the role of the hospital appears to be changing. Most obviously, hospitals are being used less. Admission rates and lengths of stay are falling for every population group, and occupancy rates are the lowest in memory.

Hospitals are now finding themselves in the position of competing for patients with other acute care settings, such as physicians offices and nonhospital emergency and surgical centers. Increased emphasis is being placed on alternatives to hospitalization, with inpatient admission increasingly being viewed as part of a continuum of care, rather than as the primary site of treatment.

Another important development is that third-party payers are becoming more actively involved in alternative forms of payment for health care, and that the distinction between payers and providers is becoming less distinct. Medicaid programs are experimenting with prospective payment and other systems, the Blue Cross and Blue Shield plans are sponsoring HMO and PPO arrangements, and the hospital chains (such as Humana and the Hospital Corporation of America) are also getting into the HMO business.

In general, economic control seems to be shifting from the providers to the purchasers of health care. Although this shifting of market power is useful, in that it has and will continue to encourage efforts to control health care costs, several cautions must be expressed. It must be remembered that, in the health care market, the purchaser is frequently not the consumer of the product. Thus, an increase in the purchaser's market power does not necessarily represent an increase in the consumer's welfare. For this reason, access and quality must be carefully monitored in the new health care environment. Also, care must be taken that certain nonmarket activities, such as teaching and research functions, are not neglected just because their value is not explicitly recognized in the market. The provision of health care to those who cannot pay for that care should also be monitored to counteract the pressure that market forces may create to neglect those individuals.

Within this context, some preliminary conclusions may be drawn about the impact of PPS in its first year. The new system appears to have been implemented smoothly and to have encouraged substantial changes in the behavior of hospitals and of other major groups within the health care sector. Many of these changes are consistent with the expectations of those who designed and enacted PPS, although some changes—particularly the drop in Medicare admissions—were not anticipated. Furthermore, the rate of growth of Medicare benefit payments appears to have decreased under PPS, led by the decline in inpatient hospital payments. It is too early yet to tell about PPS's impact on access to care and the quality of care. Still, evidence on the new system indicates that it is accomplishing many of its stated objectives, without any major problems thus far.

Acknowledgments

The authors would like to acknowledge the staffs of HCFA's Office of Research and Office of Statistics and Data Management for their great help in preparing this article. In particular, we would like to thank William Sobaski, Director of the Division of Reimbursement and Economic Studies in the Office of Research, who provided editorial comments on early drafts, and Rose Connerton and David Gibson, of the Office of Statistics and Data Management, who provided the data and interpretative advice without which this article would not have been possible.

References

American Hospital Association: PPS after the 1st year. *Hospitals*. 58(18):37–82, Sept. 16, 1984a.

American Hospital Association: *Trends*. Number 83. Chicago, Ill. Dec. 1984b.

Bell, J., Trutko, J., Feinson, C., and Beyna, L.: *Exploring the Effects of Medicare PPS on Medicaid*. HCFA Contract No. 500-83-0058. Prepared for Health Care Financing Administration. Arlington, Va. James Bell and Associates, Dec. 1984.

Blue Cross and Blue Shield Association: *Cost Containment News*. Washington, D.C. Winter 1985.

Carter, G. M., and Ginsburg, P. B.: *The Medicare Case Mix Index Increase: Medical Practice Changes, Aging, and DRG Creep*. HCFA Cooperative Agreement No. 15-C-98489/9-01. Prepared for Health Care Financing Administration. Santa Monica, Calif. The Rand Corporation, 1985.

Eggers, P.: Office of Research and Demonstrations, Health Care Financing Administration, Baltimore, Md. Personal communication, 1985.

Flood, A B., Scott, W. R., and Ewy, W.: Does practice make perfect? Part I: The relation between hospital volume and outcomes for selected diagnostic categories. *Med Care* 22(2):98–114, Feb. 1984a.

Flood, A. B., Scott, W. R., and Ewy, W.: Does practice make perfect? Part II: The relation between volume and outcomes and other hospital characteristics. *Med Care* 22(2):115–125, Feb. 1984b.

Gibson, R. M., Waldo, D. R., and Levit, K. R..: National health expenditures, 1982. *Health Care Financing Review*. Vol. 5, No. 1. HCFA Pub. No. 03154. Office of Research and Demonstrations, Health Care Financing Administration. Washington, U.S. Government Printing Office, Sept. 1983.

Health Insurance Association of America: *1984 Update: Source Book of Health Insurance Data, 1982–83*. New York. 1983.

Kusserow, R. P.: Memorandum from the Inspector General, Department of Health and Human Services, to C. McClain Haddow, Acting Administrator, Health Care Financing Administration. Oct. 29, 1985.

Lubitz, J., Riley, G., and Newton, M.: Outcomes of surgery among the aged Medicare population: Mortality after surgery. *Health Care Financing Review*. Vol. 6, No. 4. HCFA Pub. No. 03205. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Aug. 1985.

Luft, H.: The relation between surgical volume and mortality: An exploration of causal factors and alternative models. *Med Care* 18(9):940–955, Sept. 1980.

Scheffler, R. M., and Gibbs, J.: Blue Cross Utilization Rates: Before and After Prospective Payment. University of California, Berkeley, 1985.

Singer, J.: *The Effects of Medicare PPS on Medicaid Programs*. HCFA Cooperative Agreement No. 18-C-98526/1-01. Prepared for Health Care Financing Administration. Waltham, Mass. The Heller Graduate School, Brandeis University, Nov. 1985.

Waldholz, M.: Most hospitals learn quickly to be profitable. *The Wall Street Journal*, p. 6. Aug. 28, 1985.

Legislative Update

Balanced Budget and Emergency Deficit Control Act of 1985

On December 12, 1985, the President signed into law House Joint Resolution 372 (Public Law 99-177), the debt limit bill which contains a section on deficit reduction procedures. This section is the Balanced Budget and Emergency Deficit Control Act of 1985 (also called the Gramm-Rudman-Hollings bill). This new law includes several provisions affecting the Medicare and Medicaid programs.

General provisions

Deficit targets

An automatic deficit reduction procedure is established for fiscal year 1986 through fiscal year 1991, when the deficit will be zero. The deficit targets for each fiscal year will be as follows:

Fiscal year 1986	$171.9 billion
Fiscal year 1987	144.0 billion
Fiscal year 1988	108.0 billion
Fiscal year 1989	72.0 billion
Fiscal year 1990	36.0 billion
Fiscal year 1991	0 billion

In the event that the deficit is anticipated to exceed the required levels for any fiscal year, an automatic procedure will be used to achieve across-the-board reductions in the Federal budget.

Trigger mechanism and timetable

The Office of Mangement and Budget (OMB) and the Congressional Budget Office (CBO) will submit a joint report on the deficit to the General Accounting Office (GAO). This report will estimate the deficit for the fiscal year and the amount by which the deficit exceeds the specified level (above). If the deficit excess is $10 billion larger than the maximum allowance deficit amount, an automatic deficit reduction procedure (called "sequestration") will be triggered. Based on data from OMB and CBO, GAO will prepare a draft sequestration order for the President to sign which identifies the specific budget authority and all other factors, e. g., cost-of-living adjustment (COLA) amounts, outlay reductions, loan obligations, etc., to be sequestered. The legislation specifies for GAO what programs will be subject to cuts.

For fiscal year 1986, an "accelerated" timetable for deficit reduction is being followed. By January 20, 1986, GAO had to review the report of OMB/CBO and submit it to the President. By February 1, the President had to issue a sequestration order if an excess deficit amount exists. This order was effective on March 1, 1986. Any COLA paid after December 12, 1985, was deferred beginning January 1 under this plan in anticipation of sequestration. If it is later determined that a sequester order will not take effect, the COLA's would be restored retroactive to January 1.

The timetable for 1987 and beyond would be as follows:

August 15—A "snapshot" of the deficit is taken by OMB and CBO.
August 20—OMB and CBO report to GAO.
August 25—GAO issues a report to the President, based on the data from OMB/CBO.
September 1—President issues a sequestration order.
October 1—The order takes effect.
October 15—A final sequestration order is issued based on any congressional budget actions taken in September.

Presidential sequestration order

The amount to be sequestered is split evenly between defense and nondefense programs to achieve the deficit reduction specified in the GAO report. The President is given certain flexibility to target budget cuts in defense programs during fiscal year 1986 only. For fiscal year 1987 and beyond, the Presidential order must strictly adhere to the determinations set forth in the GAO report. In nondefense programs, spending reductions are divided into four categories: exempt, special procedures, uncontrollable, and controllable.

Interest on the national debt and the social security program are exempt from sequestration. Eight low-income programs are also exempt: Medicaid, Aid to Families with Dependent Children, Women and Infant Care, Supplemental Security Income, Food Stamps, Child Nutrition, Veterans' Compensation, and Veterans' Pensions.

Special procedures apply for: foster care and adoption assistance, unemployment compensation, child support enforcement, guaranteed student loans, and the Commodity Credit Corporation. For certain health programs, including Medicare, Veterans' Health, Indian Health, Community Health, and Migrant Health, a sequestration cut of 1 percent will be imposed in fiscal year 1986 and a 2-percent cut in fiscal year 1987 and thereafter. The reduction will be calculated after including any scheduled increases. If no increases are scheduled, there will be a reduction below the current level.

The uncontrollable category includes civil service pensions and other programs with annual cost-of-living increases or with automatic spending increases. If automatic cuts are made, these programs will lose only the cost-of-living increases; there will be no reduction in basic benefits. The remaining programs,

including housing, education, medical research, space and prisons, are in the controllable category and are subject to outright cuts. Total reductions must be sufficient to achieve 50 percent of the total sequestration amount.

Congressional response

In the Senate, a procedure is established to allow the Senate Budget Committee to affirm, in whole or in part, the sequestration order and provide for a congressional response setting forth procedures for formulation of an alternative congressional deficit reduction plan using a reconciliation-type process. Special procedures are established to allow the Congress to suspend certain provisions of the Act in the event of a recession or war.

The legislation permits members of Congress expedited judicial review to test the constitutionality of the deficit reduction procedure. If the President employs a constitutional prerogative not to comply with sequestration procedures, the entire order will be null and void upon a finding of the Supreme Court that the President's action was valid. The legislation also provides for a fallback procedure in the event that any part of the OMB/CBO/GAO reporting procedure is found unconstitutional. Under these circumstances, the OMB/CBO report will be transmitted to a temporary joint committee on deficit reduction, composed of the members of the House and Senate Budget Committees. The joint committee would report a joint resolution that would then trigger sequestration if enacted. Expedited consideration in both Houses would be provided.

Medicare benefit payment provisions

Special procedures apply to reductions in Medicare benefit payments. The maximum permissible reduction in fiscal year 1986 will be 1 percent, effective March 1, 1986. This will be calculated at seven-twelfths of 1 percent to reflect a partial year's computation. The reduction will be a full 2 percent for each fiscal year beginning in fiscal year 1987 through fiscal year 1991. The reduction will be calculated based on inpatient hospital prospective payment rates as published in the most recent final or proposed regulations. Scheduled increases must be included in the baseline before reductions are imposed. For purposes of sequestration, in the case of inpatient services furnished to an individual, the services will be considered to be furnished on the date of the individual's discharge from the inpatient facility.

Where payment for provider services is based on reasonable costs, payment for the costs incurred will be reduced. The reduction will apply to the part of the cost-reporting period or periods that occur during the effective period of the Presidential order. For each cost-reporting period, the reduction will be made in the same proportion as the overlap between the cost-reporting period and the effective period of the order.

For example, for fiscal year 1986 where the sequestering process begins March 1, there are only 7 months in the sequestering period. For a hospital with a cost-reporting period that begins July 1, four-sevenths of the fiscal year 1986 reduction would be taken against the cost-reporting period July 1, 1985 to June 30, 1986. The remaining three-sevenths of the fiscal year 1986 reduction would be taken against the July 1, 1986 to June 30, 1987, cost-reporting period.

If a reduction is made in Part B (supplementary medical insurance) payment amounts based on assignment, the person furnishing the services will be considered to have accepted payment of the reasonable charge for the services, less any reduction in payment amount due to the sequestration order, as payment in full.

The sequestering process will not affect the calculation of the adjusted average per capita costs used in making payments to health maintenance organizations and competitive medical plans under risk contracts. Program payments, however, will be reduced by the percentage required because of the sequestering process.

Medicaid benefit payment provisions

Medicaid benefit payments are exempt from the deficit reduction procedures.

Administrative expenses

Program management accounts for both the Medicare and Medicaid programs (e. g., research, personnel, and contractor payments) will be included in the "controllable" expenditure category, for purposes of deficit reduction. Payments made by the Federal government to reimburse or match administrative costs incurred by State or local governments will not be considered administrative expenses. Federal salaries may not be reduced below the rate of pay to which any individual is entitled under any statutory pay system. However, furloughs will be permitted.

Conference report on House Resolution 372

Following are excerpts from the *Congressional Record*, December 10, 1985, related to the Medicare and Medicaid programs from the conference report on House Joint Resolution 372, increasing the statutory limit on the public debt:

TITLE II—DEFICIT REDUCTION PROCEDURES

PART B—BUDGET SUBMITTED BY THE PRESIDENT

SEC. 255. EXEMPT PROGRAMS AND ACTIVITIES

(g) Other Programs and Activities.—

(1) The following budget accounts and activities shall be exempt from reduction under any order issued under this part:

Payments to health care trust funds (75-0580-0-1-572);

(h) Low Income Programs.—The following programs shall be exempt from reduction under any order issued under this part:

Aid to families with dependent children (75-0412-0-1-609);

Child nutrition (12-3539-0-1-605);

Food stamp programs (12-3505-0-1-605 and 12-3550-0-1-605);

Grants to States for Medicaid (75-0512-0-1-551);

Supplemental Security Income Program (75-0406-0-1-609); and

Women, infants, and children program (12-3510-0-1-605).

SEC. 256. EXCEPTIONS, LIMITATIONS, AND SPECIAL RULES.

(d) Special Rules for Medicare Program—

(1) Maximum percentage reduction in individual payment amounts.—The maximum permissible reduction for the health insurance programs under title XVIII of the Social Security Act for any fiscal year, pursuant to an order issued under section 252, consists only of a reduction of—

(A) 1 percent in the case of fiscal year 1986, and

(B) 2 percent in the case of any subsequent fiscal year, in each separate payment amount otherwise made for a covered service under those programs without regard to this part.

(2) Timing of application of reductions.—

(A) In general—Except as provided in subparagraph (B), if a reduction is made under paragraph (1) in payment amounts pursuant to a sequestration order, the reduction shall be applied to payment for services furnished during the effective period of the order. For purposes of the previous sentence, in the case of inpatient services furnished for an individual, the services shall be considered to be furnished on the date of the individual's discharge from the inpatient facility.

(B) Payment on the basis of cost reporting periods.—In the case in which payment for services of a provider of services is made under title XVIII of the Social Security Act on a basis relating to the reasonable cost incurred for the services during a cost reporting period of the provider, if a reduction is made under paragraph (1) in payment amounts pursuant to a sequestration order, the reduction shall be applied to payment for costs for such services incurred at any time during each cost reporting period of the provider any part of which occurs during the effective period of the order, but only (for each such cost reporting period) in the same proportion as the fraction of the cost reporting period that occurs during the effective period of the order.

(C) Effective period of order for fiscal year 1986.—For purposes of this paragraph, the effective period of a sequestration order for fiscal year 1986 is the period beginning on March 1, 1986, and ending on September 30, 1986.

(3) No increase in beneficiary charges in assignment-related cases.—If a reduction in payment amounts is made under paragraph (1) for services for which payment under part B of title XVIII of the Social Security Act is made on the basis of an assignment described in section 1842(b)(3)(ii), in accordance with section 1842(b)(6)(B), or under the procedure described in section 1870(f)(1), of such Act, the person furnishing the services shall be considered to have accepted payment of the reasonable charge for the services, less any reduction in payment amount made pursuant to a sequestration order, as payment in full.

(4) No effect on computation of AAPCC.—In computing the adjusted average per capita cost for purposes of section 1876(a)(4) of the Social Security Act, the Secretary of Health and Human Services shall not take into account any reductions in payment amounts which have been or may be effected under this part.

Medicare short-stay hospital length of stay, fiscal years 1981-85

by Karen Beebe, Wayne Callahan, and Antonio Mariano

The Social Security Amendments of 1983 established a prospective payment system (PPS) for most short-stay hospitals participating in Medicare. Maryland, Masschusetts, New Jersey, and New York were exempt from PPS and were paid under alternative reimbursement programs during fiscal year 1984 and fiscal year 1985, the first 2 years of PPS. In the remaining 46 States and the District of Columbia, short-stay general and specialty hospitals other than psychiatric, rehabilitation, pediatric, and alcohol and drug were phased into the PPS program effective with hospital cost-reporting periods beginning on or after

Table 1

Medicare average length of stay in short-stay hospitals and percent change, by region and waiver status: Fiscal years 1981-85

Region, waiver status, and year	Average length of stay		Percent change[1]	
	Total	PPS[2]	Total	PPS[2]
U.S. total				
1981	10.5	—	—	—
1982	10.3	—	-1.6	—
1983	10.0	—	-3.1	—
1984	9.1	7.6	-8.9	—
1985	8.4	7.7	-8.0	1.3
Northeast				
1981	12.8	—	—	—
1982	12.8	—	-0.7	—
1983	12.4	—	-3.1	—
1984	11.6	8.4	-5.7	—
1985	10.8	8.6	-7.3	2.4
North Central				
1981	10.7	—	—	—
1982	10.5	—	-1.2	—
1983	10.2	—	-3.3	—
1984	8.9	7.9	-12.7	—
1985	8.1	7.9	-9.2	0.0
South				
1981	9.7	—	—	—
1982	9.5	—	-2.3	—
1983	9.3	—	-2.3	—
1984	8.4	7.6	-9.7	—
1985	7.7	7.7	-7.5	1.3
West				
1981	8.7	—	—	—
1982	8.5	—	-2.2	—
1983	8.2	—	-3.0	—
1984	7.5	6.7	-8.9	—
1985	7.0	6.9	-6.6	3.0
Waiver States				
1981	13.8	—	—	—
1982	13.6	—	-1.7	—
1983	13.2	—	-3.2	—
1984	12.7	—	-3.9	—
1985	11.9	—	-6.1	—
Nonwaiver States				
1981	10.0	—	—	—
1982	9.8	—	-1.6	—
1983	9.5	—	-3.1	—
1984	8.5	7.6	-10.3	—
1985	7.9	7.7	-7.5	1.3

[1]Percent change for total hospitals based on unrounded data.
[2]Prospective payment system.

NOTE: Comparisons between fiscal year 1984 and fiscal year 1985 are difficult because of the geographic variation of PPS[2] phase-in during fiscal year 1984 and the lack of a full year's worth of data in fiscal year 1985, which are preliminary.

October 1, 1983. Data are presented for the United States, census regions, waiver and nonwaiver States for fiscal years 1981-85. Preliminary data are also shown for PPS versus non-PPS hospital stays for fiscal years 1984 and 1985.

- Medicare average length of stay in short-stay hospitals continued a decline in 1985 following a sharp reduction in 1984. Nationally, overall length of stay decreased from 10.5 days in 1981 to 8.4 days in 1985, a 20-percent decrease. Average length of stay in for PPS discharges remained about the same—7.6 days in 1984 and 7.7 days in 1985.
- By region, the largest absolute and relative decreases occurred in the North Central States where the average length of stay decreased by 2.6 days or 24 percent between fiscal year 1981 and fiscal year 1985. Similar but smaller decreases were recorded in the other regions.
- Prior to PPS, year-to-year percent decreases in average length of stay in the four waiver States were essentially the same as in the nonwaiver States. Since PPS, the nonwaiver States, starting with a lower average length of stay in 1983, have experienced a 17-percent decrease versus a 10-percent decrease for the waiver States.
- In all but a few States, the largest relative decrease occurred in 1984 although continuing decreases were observed in 1985. Variable rates of decrease by State were mostly due to geographic differences in the PPS phase-in periods applicable to hospitals in the different areas.

Table 2

Medicare average length of stay in short-stay hospitals and percent change, by State: Fiscal years 1981-85

State and fiscal year	Average length of stay		Percent change[1]	
	Total	PPS[2]	Total	PPS[2]
Alabama				
1981	9.2	—	—	—
1982	9.1	—	-0.9	—
1983	8.8	—	-3.6	—
1984	8.2	7.2	-7.2	—
1985	7.8	7.7	-4.0	6.9
Alaska				
1981	8.9	—	—	—
1982	8.2	—	-7.8	—
1983	8.6	—	4.5	—
1984	8.0	8.1	-7.1	—
1985	7.5	7.5	-6.3	-7.4
Arizona				
1981	9.1	—	—	—
1982	8.9	—	-3.0	—
1983	8.8	—	-0.9	—
1984	7.9	7.3	-9.9	—
1985	7.3	7.2	-8.1	-1.4
Arkansas				
1981	8.3	—	—	—
1982	8.2	—	-1.7	—
1983	8.0	—	-1.7	—
1984	7.3	6.5	-9.2	—
1985	6.9	6.8	-6.2	4.6
California				
1981	8.9	—	—	—
1982	8.7	—	-1.5	—
1983	8.4	—	-3.7	—
1984	7.7	6.9	-8.2	—
1985	7.4	7.2	-4.3	4.3
Colorado				
1981	9.5	—	—	—
1982	9.3	—	-1.9	—
1983	8.8	—	-5.2	—
1984	7.8	6.8	-11.0	—
1985	7.2	6.9	-8.7	1.5
Connecticut				
1981	11.3	—	—	—
1982	11.4	—	-1.1	—
1983	11.0	—	-3.4	—
1984	9.8	9.2	-10.4	—
1985	9.1	8.9	-7.4	-3.3

See footnotes at end of table.

Table 2—Continued

Medicare average length of stay in short-stay hospitals and percent change, by State: Fiscal years 1981-85

State and fiscal year	Average length of stay		Percent change[1]	
	Total	PPS[2]	Total	PPS[2]
Delaware				
1981	12.2	—	—	—
1982	11.8	—	-3.4	—
1983	11.4	—	-3.2	—
1984	10.4	8.5	-8.6	—
1985	9.1	9.0	-13.0	5.9
District of Columbia				
1981	15.8	—	—	—
1982	14.2	—	-10.3	—
1983	13.6	—	-3.8	—
1984	12.2	10.4	-10.6	—
1985	11.4	11.1	-6.8	6.7
Florida				
1981	9.7	—	—	—
1982	9.6	—	-0.5	—
1983	9.4	—	-2.4	—
1984	8.4	7.8	-10.1	—
1985	8.0	7.9	-4.8	1.3
Georgia				
1981	8.5	—	—	—
1982	8.3	—	-2.0	—
1983	8.2	—	-1.3	—
1984	7.6	7.0	-7.1	—
1985	7.2	7.1	-5.0	1.4
Hawaii				
1981	9.8	—	—	—
1982	9.9	—	0.5	—
1983	9.5	—	-3.4	—
1984	8.7	7.2	-8.2	—
1985	8.3	8.1	-5.6	12.5
Idaho				
1981	7.3	—	—	—
1982	7.3	—	0.0	—
1983	7.1	—	-3.0	—
1984	6.5	6.0	-8.3	—
1985	6.1	6.0	-6.3	0.0
Illinois				
1981	11.5	—	—	—
1982	11.3	—	-1.8	—
1983	10.8	—	-4.1	—
1984	9.7	8.6	-10.2	—
1985	9.0	8.6	-7.9	0.0
Indiana				
1981	10.7	—	—	—
1982	10.6	—	-0.9	—
1983	10.2	—	-3.5	—
1984	8.9	7.9	-13.1	—
1985	8.3	8.1	-7.1	2.5
Iowa				
1981	9.7	—	—	—
1982	9.8	—	0.7	—
1983	9.2	—	-6.3	—
1984	8.1	6.5	-11.5	—
1985	7.5	7.1	-7.6	9.2
Kansas				
1981	11.0	—	—	—
1982	10.6	—	-3.5	—
1983	10.3	—	-2.8	—
1984	8.7	7.2	-15.8	—
1985	7.2	7.0	-17.5	-2.8

See footnotes at end of table.

Table 2—Continued

Medicare average length of stay in short-stay hospitals and percent change, by State: Fiscal years 1981-85

State and fiscal year	Average length of stay		Percent change[1]	
	Total	PPS[2]	Total	PPS[2]
Kentucky				
1981	9.3	—	—	—
1982	9.2	—	-1.0	—
1983	9.2	—	-0.2	—
1984	8.5	7.5	-7.5	—
1985	7.7	7.6	-9.0	1.3
Louisiana				
1981	9.1	—	—	—
1982	9.0	—	-1.3	—
1983	8.7	—	-3.0	—
1984	7.9	7.2	-9.6	—
1985	7.5	7.4	-5.0	2.8
Maine				
1981	9.5	—	—	—
1982	9.3	—	-1.8	—
1983	9.0	—	-3.2	—
1984	8.4	7.6	-6.3	—
1985	8.2	8.1	-2.5	6.6
Maryland				
1981	12.5	—	—	—
1982	12.0	—	-4.2	—
1983	11.4	—	-4.9	—
1984	10.3	—	-9.1	—
1985	9.7	—	-6.0	—
Massachusetts				
1981	13.1	—	—	—
1982	13.0	—	-0.9	—
1983	12.3	—	-5.8	—
1984	11.6	—	-5.5	—
1985	10.9	—	-5.9	—
Michigan				
1981	11.0	—	—	—
1982	10.8	—	-2.1	—
1983	10.4	—	-3.0	—
1984	9.3	8.3	-10.7	—
1985	8.4	8.2	-10.3	-1.2
Minnesota				
1981	9.6	—	—	—
1982	9.4	—	-2.4	—
1983	8.9	—	-5.7	—
1984	7.7	6.8	-13.3	—
1985	7.3	7.0	-5.7	2.9
Mississippi				
1981	9.2	—	—	—
1982	9.1	—	-1.6	—
1983	8.9	—	-1.4	—
1984	7.8	7.3	-13.2	—
1985	7.5	7.3	-4.0	0.0
Missouri				
1981	10.8	—	—	—
1982	10.5	—	-3.0	—
1983	10.1	—	-3.9	—
1984	8.9	8.0	-11.5	—
1985	8.5	8.1	-5.5	1.2
Montana				
1981	7.9	—	—	—
1982	7.7	—	-2.7	—
1983	7.6	—	-0.8	—
1984	7.0	6.0	-8.1	—
1985	6.5	6.3	-7.0	5.0

See footnotes at end of table.

Table 2—Continued

Medicare average length of stay in short-stay hospitals and percent change, by State: Fiscal years 1981-85

State and fiscal year	Average length of stay		Percent change[1]	
	Total	PPS[2]	Total	PPS[2]
Nebraska				
1981	9.2	—	—	—
1982	9.0	—	-2.1	—
1983	8.8	—	-1.9	—
1984	7.9	6.9	-10.0	—
1985	7.2	7.0	-9.8	1.4
Nevada				
1981	9.2	—	—	—
1982	8.5	—	-6.8	—
1983	8.4	—	-2.1	—
1984	7.8	7.0	-6.6	—
1985	7.5	7.4	-4.4	5.7
New Hampshire				
1981	9.8	—	—	—
1982	9.7	—	-1.0	—
1983	9.3	—	-4.5	—
1984	8.6	7.8	-7.3	—
1985	8.4	8.3	-3.0	6.4
New Jersey				
1981	13.1	—	—	—
1982	12.6	—	-3.4	—
1983	12.5	—	-1.3	—
1984	12.1	—	-2.7	—
1985	11.3	—	-6.5	—
New Mexico				
1981	8.3	—	—	—
1982	8.2	—	-1.1	—
1983	8.0	—	-2.2	—
1984	7.3	6.5	-8.7	—
1985	6.9	6.7	-6.4	3.1
New York				
1981	14.7	—	—	—
1982	14.6	—	-0.7	—
1983	14.2	—	-2.5	—
1984	13.8	—	-2.7	—
1985	13.4	—	-2.7	—
North Carolina				
1981	10.3	—	—	—
1982	10.1	—	-1.4	—
1983	10.0	—	-1.4	—
1984	8.8	8.1	-11.6	—
1985	8.5	8.3	-4.1	2.5
North Dakota				
1981	8.8	—	—	—
1982	8.6	—	-2.2	—
1983	8.6	—	0.0	—
1984	7.8	7.0	-9.6	—
1985	7.3	7.0	-6.0	0.0
Ohio				
1981	11.3	—	—	—
1982	11.2	—	-1.6	—
1983	10.6	—	-4.8	—
1984	9.3	8.4	-12.2	—
1985	8.4	8.2	-10.2	-2.4
Oklahoma				
1981	8.7	—	—	—
1982	8.6	—	-0.6	—
1983	8.5	—	-1.2	—
1984	7.8	7.2	-8.9	—
1985	7.3	7.2	-5.4	0.0

See footnotes at end of table.

Table 2—Continued

Medicare average length of stay in short-stay hospitals and percent change, by State: Fiscal years 1981-85

State and fiscal year	Average length of stay		Percent change[1]	
	Total	PPS[2]	Total	PPS[2]
Oregon				
1981	8.0	—	—	—
1982	7.7	—	-3.4	—
1983	7.4	—	-4.3	—
1984	6.5	6.0	-12.0	—
1985	6.1	5.9	-7.1	-1.7
Pennsylvania				
1981	11.8	—	—	—
1982	11.6	—	-1.9	—
1983	11.1	—	-4.2	—
1984	10.0	7.8	-9.9	—
1985	8.7	8.5	-13.2	9.0
Rhode Island				
1981	12.4	—	—	—
1982	12.3	—	-0.7	—
1983	11.2	—	-8.8	—
1984	10.3	10.0	-8.0	—
1985	10.5	10.4	1.4	4.0
South Carolina				
1981	10.3	—	—	—
1982	9.8	—	-5.0	—
1983	9.6	—	-1.8	—
1984	8.8	7.9	-8.2	—
1985	8.5	8.1	-4.0	2.5
South Dakota				
1981	9.7	—	—	—
1982	9.8	—	0.6	—
1983	9.3	—	-4.7	—
1984	7.5	6.5	-20.2	—
1985	6.7	6.6	-9.8	1.5
Tennessee				
1981	9.7	—	—	—
1982	9.6	—	-1.6	—
1983	9.4	—	-1.7	—
1984	8.7	7.9	-8.2	—
1985	7.9	7.8	-8.4	-1.3
Texas				
1981	9.3	—	—	—
1982	9.3	—	-0.1	—
1983	9.0	—	-2.7	—
1984	8.1	7.2	-9.7	—
1985	7.6	7.4	-7.2	2.8
Utah				
1981	7.5	—	—	—
1982	7.6	—	1.3	—
1983	7.4	—	-2.6	—
1984	6.6	5.8	-10.5	—
1985	6.3	6.1	-5.3	5.2
Vermont				
1981	10.6	—	—	—
1982	10.7	—	0.8	—
1983	10.2	—	-4.2	—
1984	8.9	8.5	-12.6	—
1985	8.8	8.7	-1.1	2.4
Virginia				
1981	11.1	—	—	—
1982	10.9	—	-1.8	—
1983	10.3	—	-5.5	—
1984	9.3	8.4	-9.7	—
1985	8.8	8.6	-5.6	2.4

See footnotes at end of table.

Table 2—Continued

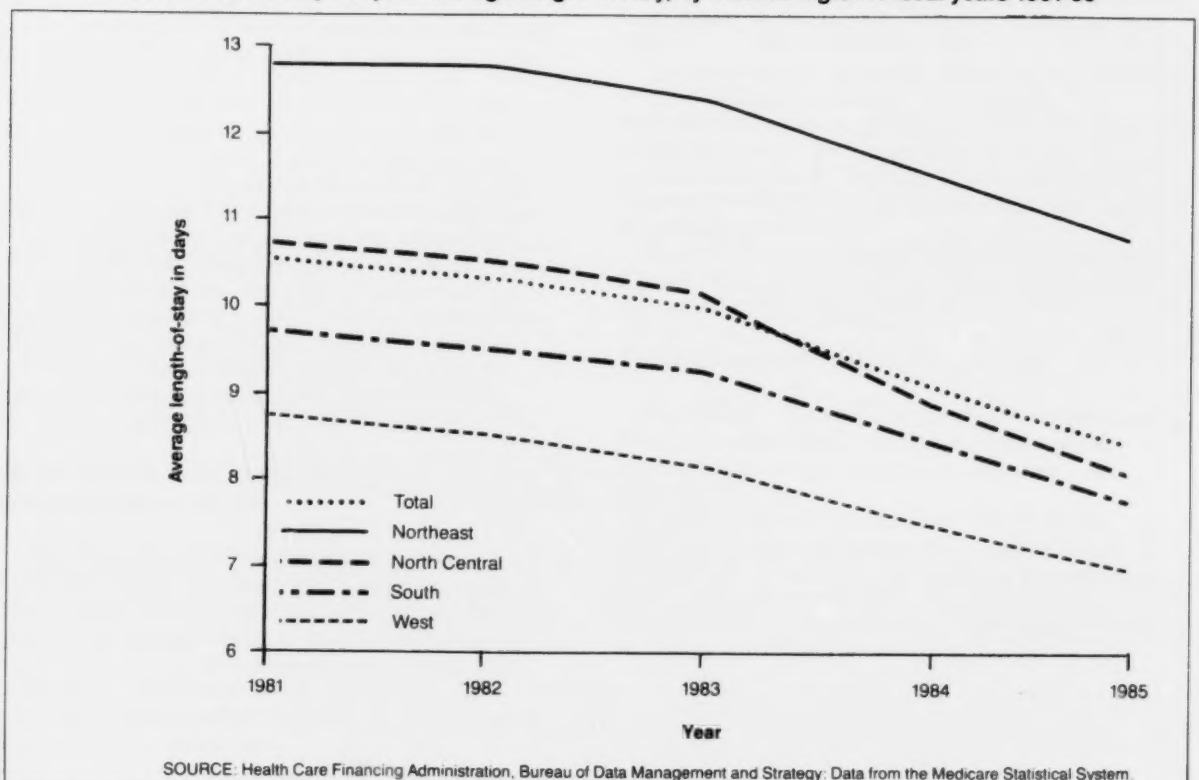
Medicare average length of stay in short-stay hospitals and percent change, by State: Fiscal years 1981-85

State and fiscal year	Average length of stay		Percent change[1]	
	Total	PPS[2]	Total	PPS[2]
Washington				
1981	7.8	—	—	—
1982	7.6	—	-2.3	—
1983	7.4	—	-2.1	—
1984	6.9	6.1	-7.8	—
1985	6.4	6.1	-6.4	0.0
West Virginia				
1981	9.9	—	—	—
1982	9.6	—	-3.2	—
1983	9.3	—	-3.0	—
1984	8.2	7.6	-12.2	—
1985	7.5	7.4	-8.8	-2.6
Wisconsin				
1981	10.5	—	—	—
1982	10.0	—	-4.6	—
1983	9.5	—	-5.4	—
1984	8.4	7.5	-11.8	—
1985	7.9	7.7	-6.0	2.7
Wyoming				
1981	8.2	—	—	—
1982	7.9	—	-2.9	—
1983	8.0	—	0.6	—
1984	7.5	6.2	-5.8	—
1985	6.6	6.5	-11.8	4.8

[1] Percent change for total hospitals based on unrounded data.
[2] Prospective payment system.

Figure 1

Medicare short-stay hospital average length of stay, by census region: Fiscal years 1981-85



SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Medicare Statistical System.

News Briefs

Directory of university-based research centers available

Directory of University-Based Health Services and Policy Research Centers, published by the Association for Health Services Research and the Foundation for Health Services Research, includes information about primary areas of expertise, funding, staffing, and training capabilities of 41 university-based centers and 9 Veterans' Administration health services research and development field programs. In addition, current research projects for each center are listed, identifying the principal investigator and funding agency for each. These projects are indexed by subject, funding agency, and researchers.

Cost for the 103-page directory is $5.00 for members and $10.00 for nonmembers. Send check or money order to: Association for Health Services Research, 2100 M Street, NW., Suite 402, Washington, D.C. 20037, (202) 223-2477.

Health policy research meeting scheduled for Boston

The third annual meeting of the Association for Health Services Research and the Foundation for Health Services Research will be held in Boston on June 22-24, 1986. The theme is health services and public policy.

The conference will feature sessions on such health policy research issues as quality of care, aging and long-term care, academic health centers in a competitive environment, changing world of the physician, and research on prospective payment. Intensive methodological workshops will also be offered. The President of the Association, Gordon DeFriese, from the University of North Carolina at Chapel Hill, will present the keynote address, and Walter McNerney, from Northwestern University, will moderate a debate on "For-Profit versus Not-For-Profit Role in Health Care." Uwe Reinhardt, from Princeton University, will be the closing speaker.

For more information contact: Association for Health Services Research, 2100 M Street NW., Suite 402, Washington, D.C. 20037, (202) 223-2477.

Home health care book provides comprehensive advice

The Home Health Care Solution: A Complete Consumer Guide, by health care consultant Janet Zhun Nassif, M.P.H., outlines, step-by-step, how to take full advantage of this cost-effective alternative health care system, providing diagnosis, treatment, monitoring, rehabilitation, and supportive care provided at home, rather than in a hospital, nursing home, or other institution.

This resource book offers guidelines on the full range of services available, payment options and savings, hospice care, emergency response systems, and alternatives to home care.

The book is available for $17.95 cloth and $9.95 paper from Harper and Row, 10 East 53rd Street, New York, New York 10022. For more information call (212) 207-7250.

Two publications available on rural health maintenance organizations

Rural America is the new frontier for health maintenance organization (HMO) development, concludes InterStudy, after an 18-month study funded by the Office of Health Maintenance Organizations, Department of Health and Human Services.

InterStudy has produced two companion publications addressing the special issues involved in starting HMO's in rural areas: *Considerations in Studying the Feasibility of Rural HMO* asks the questions necessary for deciding whether or not an HMO can prosper in a given rural area, and *Considerations in Developing a Rural HMO* outlines the major tasks involved in translating positive results of a feasibility study into creation of an HMO with good prospects for survival.

Both reports examine five major areas of emphasis in HMO development: organization and management, legal issues, health services delivery, marketing, and finance.

These reports are intended to assist those wishing to develop or expand an HMO in a rural or nonmetropolitan area, including community leaders, major employers, area physicians and hospitals, metropolitan HMO's considering expansion, and regional/national HMO firms seeking to develop subsidiaries or affiliates.

Both of these reports can be ordered at a cost of $20 each from InterStudy, P.O. Box 458, Excelsior, Minnesota 55331, (612) 474-1176.

Publications list available

The United Hospital Fund of New York produces a range of health-related publications that include practical handbooks, analysis of data bases, and indepth policy papers.

A listing *Current Publications, 1986* provides synopses on available publications and ordering information. A copy may be obtained by contacting Sally J. Rogers, Publications Program, United Hospital Fund, 55 Fifth Avenue, New York, New York 10003, (212) 645-2500.

Publications now available from HCFA

The following reports from the Health Care Financing Administration (HCFA) are available on a complimentary basis from JoAnn Jackson, Information Resources Specialist, at (301) 597-2422.

Recipients of Covered Services Among Medicaid Enrollees: Michigan and New York, 1981

This is the first report of its type on the Medicaid program. It provides recipient rates by institutional status, maintenance assistance status, age, and sex.

Medicare: Participating Providers and Suppliers of Health Services, 1983

This report analyzes trends from 1976 through 1983 in the number and type of Medicare participating provider of services.

Medicare: Use and Cost of Short-Stay Hospital Services by Beneficiaries with the Principal Diagnosis of Alzheimer's Disease, 1980

This report presents program data on aged and disabled Medicare beneficiaries who were hospitalized with the principal diagnosis of Alzheimer's disease.

National Heart Transplantation Study

This report reviews a comprehensive 3-year study that examined all aspects of heart transplants, including scientific, social, economic, and ethical issues and, in particular, the impact of a possible Medicare decision to pay for heart transplants on the Medicare program.

Medicare: Liability of Persons Using Reimbursed Physicians' Services, 1980

This report presents detailed statistics on the liability incurred by persons reimbursed for physicians' and other medical services under Medicare's supplementary medical insurance program in 1980.

The Medicare Study of the Cooperative Health Education Project

This report reviews a randomized, controlled, prospective trial of self-care interventions offered for 1 year to the Medicare population of a health maintenance organization, the Rhode Island Group Health Association.

Case Management and Prepaid Capitation for Delivery of Dental Services

This report discusses the Massachusetts Dental Project, a 4-year research demonstration study, whose goal was to assess the capitated financing method of delivering dental services to recipients of Aid to Families with Dependent Children.

Analysis of State Medicaid Program Characteristics, 1984

This report reflects State Medicaid program characteristics as of March 31, 1984, and was prepared by the Division of Medicaid Cost Estimates, Office of the Actuary.

Publications now available from the U.S. Government Printing Office

These reports are available from the Superintendent of Documents, U.S. Government Printing Office (GPO), Washington, D.C. 20402. Reports must be ordered by title and stock number directly from GPO. Send check or money order for the price listed.

Marketing Medicare in a Competitive Environment

This report is the first empirical study of the Medicare beneficiary as a consumer of both health insurance and health care delivery provided by risk-based alternatives to the existing Medicare program. Beneficiary choice of risk-based prepaid health plans is analyzed and the characteristics of plan joiners, the reasons Medicare beneficiaries join HMO's, and beneficiary satisfaction with the HMO alternative are examined.

Stock No. 017-060-00181-0
Price: $1.25

Status Report: Research and Demonstrations in Health Care Financing, January 1986 Edition

This report provides updated information in a brief format on the nearly 300 intramural and extramural projects conducted by the Office of Research and Demonstrations. These projects seek alternate ways to finance and deliver health services, as well as assess the impact of Federal health care programs on health care costs, providers, and beneficiaries.

Stock No. 017-060-00182-8
Price: $9.50

Statistical components handle inquiries

Inquiries regarding the availability of statistical information other than those pertaining to the specific contents of articles in the *Health Care Financing Review* should be directed to the following components:

Medicare statistics

Statistical Information Services Branch
Office of Statistics and Data Management
Bureau of Data Management and Strategy
Room 1-F-2, Oak Meadows Building
6325 Security Boulevard
Baltimore, Maryland 21207
Telephone: (301) 594-6705

Medicaid statistics

Division of Medicaid Cost Estimates
Office of Actuarial Analysis
Office of the Actuary
Room 1-K-1 Equitable Building
1705 Whitehead Road
Baltimore, Maryland 21207
Telephone: (301) 597-6107
(301) 597-1417

Grants and Contracts

The Health Care Financing Administration (HCFA) administers a grants and contracts program for research and demonstration projects through the Office of Research and Demonstrations (ORD).

The following list contains information on new ORD contracts awarded at the beginning of fiscal year 1986. Other grants and contracts projects have been included in earlier issues of the *Health Care Financing Review*.

As projects are completed, the final reports are placed with the National Technical Information Service for public access. Further information may be obtained from:
National Technical Information Service
Document Sales
5285 Port Royal Road
Springfield, Virginia 22151
(703) 487-4650

Project area: Coverage

Category: Technology costs

Title:
Diffusion of artificial internal organ technology.

Project number:
18-C-98741/4-01

Contractor/Grantee:
University of North Carolina
Department of Health Policy and Administration
263 Rosenau Hall, 201H
Chapel Hill, NC 27514

Project director:
Gregory V. DeLissovoy

Federal project officer:
Paul Eggers

Description:
The main objectives of this research study are to develop an economic model of the Medicare funded end-stage renal disease program, and generalize the model to home total parenteral nutrition and other types of artificial internal organ technology.

Administrator's Decisions

Under Section 1878(f) of the Social Security Act, as amended, a Provider Reimbursement Review Board (PRRB) decision is final unless the Secretary, Department of Health and Human Services, on his own motion, and within 60 days after the Provider is notified of the Board's decisions, reverses, affirms, or modifies the Board's decision. The review function has been delegated to the Administrator/Deputy Administrator of the Health Care Financing Administration.

The two indexes are lists of the Administrator's decisions rendered on review of PRRB decisions and of PRRB decisions the Administrator elected not to review. These indexes are in numeric order by PRRB decision number. They also state the name of the provider, issues involved, and date of Administrator's action.

Numeric index of Administrator's final decisions rendered on review of PRRB decisions—October 1, 1985 through December 31 1985.

82-D123R *Winter Park Memorial Hospital*—Labor/delivery room days (12/18/85)

85-D82 *Baptist Memorial Hospital*—Interest expense (09/19/85)

85-D87 *St. Luke's Episcopal Hospital*—Inhalation therapy costs (09/30/85)

85-D89 *Butler Hospital*—Discrete costing of vacant space; Special care unit (09/30/85)

85-D97 *Arlington Hospital*—Scrap silver sale (10/10/85)

85-D99 *Bladen County Hospital*—Physical therapy costs (11/01/85)

85-D101 *Frankford Hospital*—Security costs; Health care costs; Management study costs (11/06/85)

85-D105 *Sun Bay Community Hospital*—Income tax expense; Stock maintenance costs; Income tax liabilities; Malpractice insurance costs; Return on equity capital; Medical office building costs; Administrative and legal costs contributions; (11/13/85)

85-D106 *Council Community Hospital*—Routine care costs (11/14/85)

85-D107 *Charter Baywood Hospital*—Crisis evaluation costs; Patient school costs; Substance abuse center costs (11/14/85)

85-D109 *Jane Phillips Episcopal Memorial Medical Center*—Sole community provider exemption (11/25/85)

85-D111 *Trinity Regional Hospital of Fort Dodge*—Sole community provider exemption (11/26/85)

86-D1 *Dekalb General Hospital*—Respiratory therapy costs; Labor/delivery room days (11/26/85)

86-D2 *Stormont-Vail Regional Medical Center*—Labor/delivery room days (12/05/85)

86-D6 *St. James Hospital*—Routine cost limits (12/18/85)

86-D8 *General Hospital of Fort Walton Beach*—Income tax expense; Stock maintenance costs; Income tax liabilities; Lease tax expense (12/20/85)

86-D9 *National Medical Enterprises, Inc.*—Income tax expense; Income tax liabilities (12/19/85)

86-D16 *General Hospital of Fort Walton Beach*—Lease payment tax (12/17/85)

85-604G *Mercy Hospital of Folsom*—Jurisdiction (11/25/85)

83-577 *LAC/Rancho Los Amigos Hospital*—Jurisdiction (12/13/85)

Numeric index of Administrator's remands rendered on review of PRRB decisions—October 1, 1985 through December 31, 1985.

85-D94 *Huntsville Memorial Hospital*—Depreciation; Labor/delivery room days; Malpractice insurance; Return on equity capital (09/26/85)

Numeric index of Administrator's election to decline review of PRRB decisions—October 1, 1985 through December 31, 1985.

85-D95 *Scottsdale Memorial Hospital*—Interns' and residents' services; Clinical engineering costs; Standby fees; Interest income; Laboratory charges (09/30/85)

85-D96 *Martin Place Hospital*—Disposal of assets (09/23/85)

85-D98 *Cole Hospital*—Related organizations (10/15/85)

85-D100 *Schuyler Hospital*—Administrative costs (10/18/85)

85-D102	*Riverside Psychiatric Hospital*—Inventory of assets (10/17/85)
85-D103	*Moses-Ludington Hospital*—Interest and penalty expenses (10/11/85)
85-D104	*Walter O. Boswell Memorial Hospital*—Interest expense; Interest income offset; Malpractice insurance costs (11/06/85)
85-D108	*Bryan Community Hospital*—Pension plan costs (10/29/85)
85-D110	*Marion Health Center*—Bad debts (10/29/85)
86-D3	*Shoals Hospital, Inc.*—Debt service funds; Renal dialysis costs (11/18/85)
86-D5	*Florida Medical Center Hospital*—Return on equity capital (11/14/85)
86-D7	*Phelps County Regional Medical Center*—Interest expense (12/02/85)
86-D10	*Allen Home Health Agency*—Owner's compensation; Pension costs; Automobile expenses (12/02/85)
86-D11	*South Highlands Hospital*—Standby costs (12/02/85)
86-D12	*St. Francis Hospital, Inc.*—PSRO costs (12/02/85)
86-D13	*A Visiting Redi-Nurse, Inc.*—Return on equity capital (12/02/85)
86-D14	*Pioneer Hospital*—Lease expenses; Return on equity capital (12/20/85)
86-D15	*St. Louis University Hospital*—Malpractice insurance costs; Payments to noncivic organizations (12/03/85)
86-D17	*Aishel Avraham Nursing Home*—Physicians services (12/10/85)
86-D18	*The Fairmount Institute*—Depreciation; Interest expense (12/11/85)

Contributors

Ross H. Arnett, III, is a senior economist in the Division of National Cost Estimates, Office of the Actuary, Health Care Financing Administration. As Chief of the Health Projections Branch, he is in charge of a number of projects related to national health projections and the Medicare prospective payment system.

Christine E. Bishop, Ph.D., is senior research associate at the Health Policy Center, Heller Graduate School, Brandeis University. She has conducted research and policy analysis dealing with a broad range of topics in the economics of long-term care for the disabled elderly. Studies include work on nursing home reimbursement, home health care costs, use, and reimbursement, continuing care retirement communities, and long-term care insurance. She is continuing the investigation of the living arrangement choices of older Americans in a project funded by the National Institute on Aging.

Joel Bobula is an economist in the Long Term and Special Studies Branch, Office of Research, Health Care Financing Administration.

Rose Connerton is a supervisory computer specialist in the Office of Statistics and Data Management, Health Care Financing Administration.

Philip Cotterill, Ph.D., is an economist and Chief of the Long Term and Special Studies Branch, Office of Research, Health Care Financing Administration.

Carol S. Cowell is a senior program analyst in the Division of National Cost Estimates, Office of the Actuary, Health Care Financing Administration. She has worked extensively on national health expenditure projections and Input Price Indexes for hospitals, nursing homes and home health agencies since 1978. Her previous articles have appeared under her maiden name, Schendler.

Allen Dobson, Ph.D., is Director of the Office of Research in the Health Care Financing Administration (HCFA). His current research activities focus primarily on prospective payment schemes for hospitals, physicians, and skilled nursing facilities, the evaluation of HCFA programs, the development and use of population-based statistical systems to support research on HCFA beneficiaries, and the use of survey activities (such as the National Medical Care Utilization and Expenditure Survey) to augment analyses of HCFA program impacts.

Stuart Guterman is an economist in the Division of Reimbursement and Economic Studies, Office of Research, Health Care Financing Administration (HCFA). He is currently supervising HCFA's efforts to evaluate the Medicare hospital prospective payment system (PPS) for the congressionally mandated annual report on the impact of the PPS.

Richard L. Lichtenstein, Ph.D., is assistant professor of medical care organization at the University of Michigan, School of Public Health. He received both the M.P.H. and Ph.D. degrees from the University of Michigan. His recent research interests have included: investigating the effects of unemployment on health insurance coverage and health status, measuring the job satisfaction of physicians in organized settings, and improving Medicare's adjusted average per capita costs.

James Lubitz is Chief of the Analytical Studies Branch, Office of Research, Office of Research and Demonstrations, Health Care Financing Administration. His research interests include expanding the applications of administrative data bases for epidemiological and health services research.

John Holahan, Ph.D., is Director of the Health Policy Center at the Urban Institute in Washington, D.C.

David R. McKusick is a Fellow of the Society of Actuaries and member of the staff of Actuarial Research Corporation. His current research interest is in economic demography.

Ronald Priholda is a senior computer specialist in the Office of Statistics and Data Management, Bureau of Data Management and Strategy, Health Care Financing Administration. He is currently working on the extraction and analysis of data relating to the utilization and cost of Medicare health services.

Gerald Riley is a research analyst in the Division of Beneficiary Studies in the Office of Research, Health Care Financing Administration. His current research topics include Medicare utilization in the last year of life by cause of death, modifications in health maintenance organization reimbursement, and the beneficiary impact of prospective payment.

Sally T. Sonnefeld is a program analyst in the Division of National Cost Estimates, Office of the Actuary, Health Care Financing Administration.

Mary Ann Stevenson works in the Division of Software Development and Statistical Programming, Office of Statistics and Data Management, Bureau of Data Management and Strategy, Health Care Financing Administration.

Margaret B. Sulvetta is a research associate in the Health Policy Center at the Urban Institute in Washington, D.C.

J. William Thomas is associate professor of medical care organization at the University of Michigan, School of Public Health. He holds a Ph.D. in applied economics from the Wharton School at the University of Pennsylvania. His recent research has focused on payment system issues, including improvement of the adjusted average per capita cost and severity adjustment for the prospective payment system.

Reviewers

The *Review* would like to acknowledge and thank the following people for their time and effort in serving as reviewers.

James Bentley, Ph.D.
Association of American Medical Colleges

James R. Cantwell
General Accounting Office

Rosanna Coffey, Ph.D.
National Center for Health Statistics Research

Stephen M. Davidson, Ph.D.
Boston University School of Management

Rose Dobrof, Ph.D.
Brookdale Center on Aging at Hunter College

Warren Greenberg, Ph.D.
George Washington University

Ronald Harris, F.S.A., M.A.A.A.
Miliman and Robertson

Susan Horn, Ph.D.
Johns Hopkins University

Bryan R. Luce, Ph.D.
Battelle Human Affairs Research Center

Robert Newcomer, Ph.D.
University of California, San Francisco

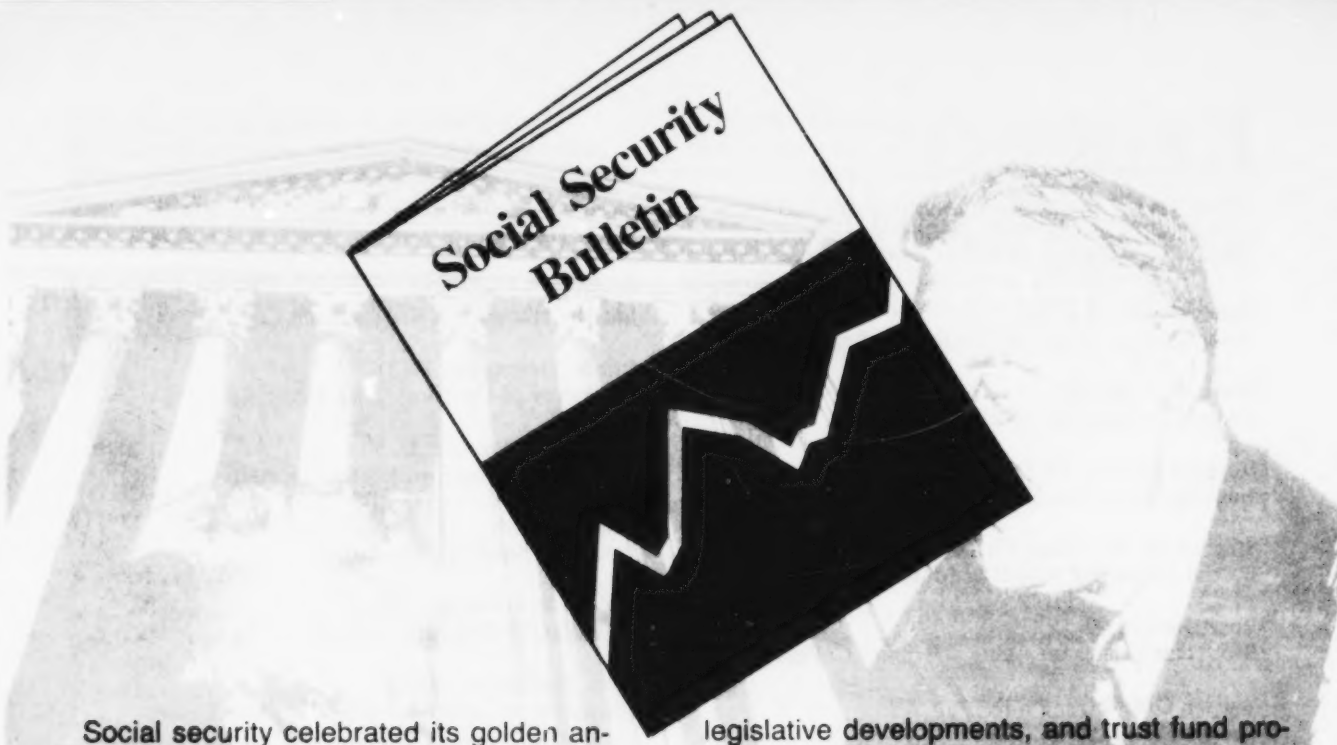
Dorothy P. Rice, Sc.D.
University of California, San Francisco

Ann Scitovsky
Palo Alto Medical Foundation

Donald P. Schneider, Ph.D.
Rensselaer Polytechnic Institute

Peter Shaugnessy, Ph.D.
University of Colorado Health Sciences Center

*U.S. GOVERNMENT PRINTING OFFICE: 1986-491-260:40002



Social security celebrated its golden anniversary in 1985. The program which came into being in 1935 and paid monthly benefits to less than a quarter million Americans in 1940 now serves over 36 million beneficiaries each month.

Since 1938, the *Social Security Bulletin* has recorded the operations of the Nation's primary income maintenance plan for retired and disabled workers, their dependents, and survivors. The *Bulletin* provides statistics and analysis on all phases of social security and related programs, beneficiary characteristics, trends in coverage of the working population, legislative developments, and trust fund projections. Beginning in 1985 and still continuing in the *Bulletin* are periodic analyses from the most recent study of social security beneficiaries — the 1982 New Beneficiary Survey.

Stay informed on social security as the program enters its second half century of service. Subscribe now to the *Social Security Bulletin* with the convenient order form below. A copy of the **Annual Statistical Supplement** to the **Bulletin**, containing more than 200 detailed statistical tables, is included without charge in the subscription price.

To: Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Enclosed find $ _____
(check or money order),
or charge to my Superintendent of Documents Deposit Account Number shown above.

Social Security Bulletin:

☐ Subscription:	domestic	$23.00
	foreign	$28.75
☐ Single copy:	domestic	$2.50
	foreign	$3.13
☐ Supplement only	domestic	$6.50
	foreign	$8.13

Note: Prices subject to change. Call GPO at 202-783-3238 for current pricing information.

VISA
MasterCard

Credit Card Orders Only
Total charges $ _ _ _ _ _ _ Fill in the boxes below:
Credit Card No.
Expiration Date Month/Year
Master Charge Interbank No.

Deposit Account Number

5 NAME - FIRST, LAST 28

29 COMPANY NAME OR ADDITIONAL ADDRESS LINE 54 8Q 2

29 STREET ADDRESS 54

55 CITY 68 STATE 71 ZIP CODE 75

(or) COUNTRY

PLEASE PRINT

What's new in health care financing?

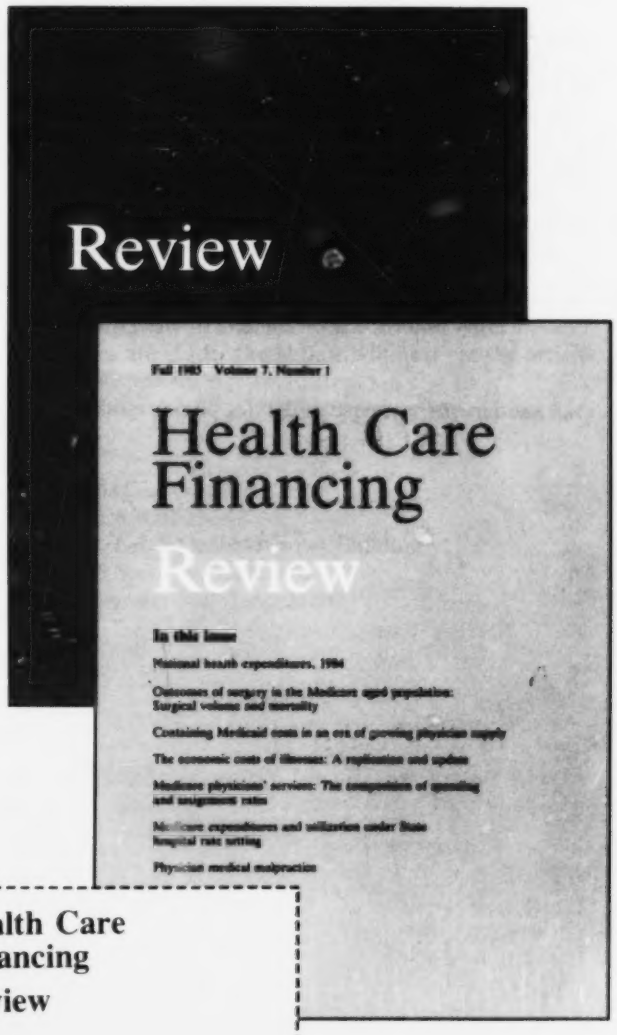
Subscribe now to the journal that keeps you informed

Health Care Financing Review gives you the information you need to keep up with today's changes and tomorrow's trends in health care financing at the Federal, State, local, and private levels.

Four quarterly issues bring you:

- Current statistics and projections on national health care costs and expenditures.
- Timely reports by economic experts who monitor Medicare and Medicaid funding changes.
- Original research articles on innovative health care financing and delivery systems, prospective payment approaches, long-term care options, and utilization and coverage issues.
- Updates on new legislation and changes to existing laws that affect Medicare and Medicaid policy.
- Summaries of research and demonstration projects being funded by the Health Care Financing Administration.
- Announcements of new developments and programs, conferences, and publications of vital interest to the health care community.

You also get an annual supplement issue on a topic of special interest with in-depth coverage by leading experts who examine and assess new methods and policy concerns for providing quality health care in an era of cost containment.


Review
Fall 1985 Volume 7, Number 1
Health Care Financing
Review
In this issue
National health expenditures, 1984
Outcomes of surgery in the Medicare aged population: Surgical volume and mortality
Containing Medicaid costs in an era of growing physician supply
The economic costs of illnesses: A replication and update
Medicare physicians' services: The competition of spending and assignment rates
Medicare expenditures and utilization under State hospital rate setting
Physician medical malpractice

Great value

For just $18.00 a year ($22.50 foreign), you receive five issues packed with the kind of technical information and research results you need to be on the leading edge of health care financing programs, policies, and approaches.

YES! I want to get the latest information on health care financing issues. Enter my subscription to the *Health Care Financing Review*.

☐ Check or money order made payable to **Superintendent of Documents** for $18.00 ($22.50 foreign) enclosed.

☐ Charge to my ☐ Visa ☐ MasterCard

Acct. No.: Exp. Date:

Signature:

Name:

Address:

City/State/Zip:

Health Care Financing Review

Return to:

Health Care Financing Administration
Publications and Information Resources
Room 1-A-9 Oak Meadows, HCFR-6
6325 Security Boulevard
Baltimore, Maryland 21207

Information for authors

The *Health Care Financing Review* welcomes potential articles from readers. Papers to be considered for publication should discuss health care research, policy, the development of a particular project or demonstration, or any other subject which the author thinks would interest the *Review* audience. This audience comprises Congress, Federal, and State and local officials, as well as health care providers, insurers, planners, and researchers.

The by-line should cite those who have contributed significantly to the work; those who have participated only in an advisory or supporting capacity should be thanked in the Acknowledgments.

The author submitting an article should state in a cover letter that the content and wording in the acknowledgment have been approved by those mentioned. We regard this precaution as essential because thanking colleagues for their help may be interpreted to mean that they approve of the article. If they do not, they may object to being mentioned.

Each article should begin with an abstract of 100 words or less. The abstract should acquaint the prospective reader with the essence of the text by presenting, very briefly, the essential points made in the article. It should be intelligible when divorced from the article and devoid of any undefined abbreviations.

Articles should be approximately 25 to 35 doublespaced typed pages, including up to a maximum of 10 tables and figures; the *Review* cannot reproduce photographs. All tables, charts, and other art should be clear without reference to the text. They should be individually and succinctly titled; their footnotes should be keyed with numbers rather than symbols. Tables should not have vertical lines or leaders. All art should be black and white only.

References within the text should consist of the author's name and the date of publication, within parentheses. Anything attributed to another author is a reference, not a footnote; the two should be clearly distinguished. Complete references should be listed in alphabetical order by author at the end of the paper. Additionally, the author should state in the cover letter that the content and wording of references to unpublished work have been approved by the person(s) whose work is quoted. That person's current address should also be given.

Footnotes should be numbered sequentially throughout the article. Any information that expands on or explains the text should be footnoted.

All submitted manuscripts will be reviewed by the Executive Editor for their relevancy to the health care financing field. Articles of interest will be referred to the Associate Editors and subject-matter experts for peer review, and their comments will be forwarded to the authors. Authors whose manuscripts are accepted for publication will be required to make revisions based on these critiques. Authors whose articles are accepted for publication are given 3 days in which to look over the galley proofs of their articles. Discounting typographical errors, authors may make no more than 10 changes to the article. After these changes are made, the author will next see the article in published form.

Authors should send five copies of the manuscript to:

Managing Editor
HCFA/ORD
Rm. 1-A-9 Oak Meadows Building
6325 Security Boulevard
Baltimore, Maryland 21207

U.S.DEPARTMENT OF
HEALTH AND HUMAN SERVICES
HEALTH CARE FINANCING ADMINISTRATION
ROOM 1A9, OAK MEADOWS BLDG.
6325 SECURITY BLVD.
BALTIMORE, MARYLAND 21207

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

U.S. Department of Health and Human Services
Health Care Financing Administration
Office of Research and Demonstrations
HCFA Pub. No. 03222 April 1986